Railway Age

DAILY EDITION

FIRST HALF OF 1922—No. 10b CHICAGO—WEDNESDAY, MARCH 15, 1922—NEW YORK SIXTY-SEVENTH YEAR

Published weekly by Simmons-Boardman Pub. Co., Woolworth Bldg., New York, N. Y. Subscription Price U. S., Canada and Mexico, $6.00; foreign countries (excepting daily editions), $8.00; single copies, 25c. Entered as second-class matter, January 30, 1918, at the post office at New York, N. Y., under the act of March 3, 1879. Daily edition application made at the post office at Chicago, Ill., for entry as second class matter. Chicago office, Transportation Building.

Alphabetical Index to Advertisements, Page 22

Railway Age

EDITORIAL

DAILY EDITION

Contents

Securing the Best Test Tie

White oak has long been considered the best of woods available in any commercial quantity for cross tie purposes, a condition which the Committee on Ties duly realized in submitting its plan for a standard test tie. The life of ties varies widely, however, even within the same class of wood, as the discussion brought out and as the committee no doubt realized. Two valuable suggestions were made during the discussion, namely, that the standard test tie shall be all heartwood and that all such ties shall be secured from the same section of the country. Since the number of ties needed for the purpose of establishing a basis of comparison will naturally be small and since the expense will likewise be small, if not even infinitesimal, when the advantages of the plan are considered, why not go a little further? Why not draw up a special specification for a standard test tie more rigid than the regular specification for white oak cross ties and incorporate in it every requirement necessary to secure a tie as uniform in its growth, structure and other characteristics as it is possible to get? Certainly such a specification could be complied with easily for the limited quantities required and such a specification would render comparisons of tie life far more reliable and trustworthy. There is the objection to this that it might prevent a road from securing and installing standard test ties but, on the other hand, it is reasonable to assume that any road sufficiently desirous of securing more comparable data through the use of a standard test tie, will not hesitate over the slight additional trouble caused by a more rigid specification.

Testing Signal Relays

Definite instructions for the making of shop or field tests and inspections of signal relays are presented for the first time in the report of the Committee on Electrical Testing. The reliable operation of the relay is of paramount importance in the working of railway signal apparatus. However, too many roads neglect the proper inspection of relays at specified intervals, resulting in some cases in serious accidents. These specifications fix concisely the contact opening, the contact resistance, and the drop-away and pick-up values to be adhered to, leaving no room for the inspector to introduce individual opinions or erroneous instructions in this important part of signal maintenance work. It would seem advisable for roads which do not now have a complete system of testing to incorporate these specifications in their rules for signal maintenance.

It Is Up to the Management

There is food for thought in President Down's comments on the employment of engineers in railway service. In his address yesterday morning he presented two pertinent facts—(1) that the railways are not getting their proportion of the engineering graduates and (2) that in one section of the country at least, the roads are paying the men from the technical schools less, to start, than they are paying firemen, brakemen or switchmen. Of course, the initial employment of the graduate on a railroad is in the nature of an apprenticeship during which he receives a training offering much greater opportunity for advancement than that open to the man entering train service. But whatever the merits from the standpoint of fair compensation, the real problem is a rate of pay for technical graduates which will attract high grade men. The efforts of an organization of technical men to cope with this problem were founded on an unsound premise and have been a conclusive failure. This is a problem for the managements, therefore it is up to the higher engineering officers to bring it to their attention.

Economics of Railway Signaling

The first report of the new committee on Economics of Railway Signaling, was presented at the meeting of the Signal section Tuesday. The function of this committee is to secure information on the relative economic values of railway signaling installations as a means of protecting and facilitating the movement of trains and causing reductions in the cost of railroad operation. The members of this committee are in a position to secure accurate information presented in terms of dollars and cents regarding the actual economics derived from signal installations now in

service or installations that are proposed. Heretofore the real proof of the economic advantages of automatic signals has been more or less intangible. However, there is every evidence that the Signal section, by means of this new committee, means to show the railroad managements the benefits of signaling. It is to be hoped that the members of the Operating and Engineering divisions of the A. R. A., interested in this subject will give their assistance in the studies to be made by this new committee to the end that the railroads may be advised fully of the possible economics without delay.

Engineer or Railroad Man?

WHAT SHOULD BE the real purpose of the work of the civil engineer in railroad service? It should be the same as that of every man in every branch of the operating department. It should be to help the railways produce more and better ton miles and passenger miles and produce them cheaper.

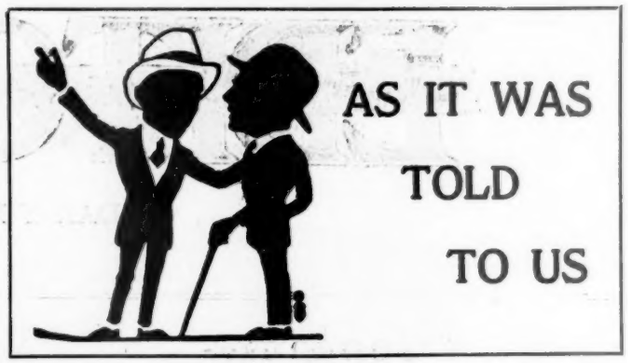
The railroad is simply one kind of a factory. It makes freight and passenger transportation. The only way men in the operating department, whether they be transportation men, mechanical men or engineering men, can contribute effectively toward the success of the railroads is by helping furnish better transportation and furnish it at the minimum practicable cost.

No engineer can do his part in bringing about the desired end unless he is a good engineer. It is equally true that no railroad engineer can do his work efficiently unless he is a good railroad man. The best designed, constructed and maintained track, bridge or building, does not serve its true purpose unless it is so designed, constructed and maintained as to enable the railway to render service better or at a lower cost.

It is obvious, therefore, that an engineer, to be a real success in railroad work, must know a great deal besides engineering. This thought is implicit in the article by President Aishton of the American Railway Association, which was published in the Daily of March 14, although it is not expressed in so many words. No engineer can be of the greatest practicable value to his railroad unless in everything he does he considers clearly and thoroughly the effect it is going to have upon the efficiency and economy with which passenger and freight service are rendered. But nobody can clearly and fully consider the effect a piece of engineering work is going to have on the efficiency and economy of operation unless he constantly studies and acquires a thorough understanding of the economics of operation.

Unfortunately, some technical men on the railways do not recognize this fact and act accordingly. They study engineering mainly as a distinct science and carry on engineering work as a distinct art, instead of studying thoroughly its relationship to railroad operation and always doing their work with the definite purpose of providing facilities which the maintenance department can maintain and the operating department can use with the utmost economy.

It is a notable fact that the engineers who have risen to the highest executive positions on the railways always have been first of all railway men. That is the reason why they have risen to the highest positions. The engineer who always thinks in engineering terms, reads only engineering literature and never considers any of the problems of any branch of the railroad business except the engineering, will always be an engineer rather than a railroad man and is likely never to rise above a subordinate position even in the engineering department; for every important chief engineer in the country is quite as good a railroad man as he is engineer.



The Atchison, Topeka & Santa Fe, Coast Lines, are proceeding with the construction of a second track on 75 miles of line between Yampai, Ariz., and Griffith, which will be equipped with color-light automatic block signals, operated by alternating current.

* * *

K. Furukawa, electrical engineer on the Japanese Government Railways, Tokyo, Japan, was in attendance at the Signal section meeting at the Drake hotel yesterday. He also intends to spend considerable time at the Coliseum, investigating various labor saving and other devices which are on exhibit.

* * *

The regular weekly luncheon of the Chicago Association of Commerce at the Hotel LaSalle this noon will be conducted under the auspices of the Railway Supplies Division of the association. Samuel O. Dunn, editor of the Railway Age, will speak on The Railway Situation to Date.

* * *

Among the roads which are going to heavier rail this season may be included the Great Northern, which has ordered a sufficient tonnage of 130-lb. P. S. rail to lay 5½ miles on sharp curves on its western mountain divisions. Up to the present time, rail of 90-lb. section has been the heaviest used on this road and so far as it is known this is the first instance of rail as heavy as 130-lb. being installed west of Chicago.

* * *

The executive committee of the Roadmasters' Association met at the Auditorium hotel yesterday to consider the affairs of that organization. A number of chairmen and members of the committees joined with the executive committee at luncheon at 12:30 after which the afternoon was spent in the consideration of the reports of the committees which will be presented at the convention in Cleveland in September.

* * *

Jukichi Fuzine of the South Manchuria railway, Dairen, Manchuria, probably holds the record of having traveled the longest distance to attend the convention. Mr. Fuzine registered yesterday as did also Leon F. Lommbladh, consulting engineer, LaCeiba railway, Honduras, C. A. Mr. Lommbladh was formerly chief engineer of the Missouri, Kansas & Texas, of Texas.

* * *

The attendance at the Signal section stated meeting for the two days was the largest of which there is record, the total registration at the time of closing amounted to 400, 112 of whom were affiliated members and two guests. Five railroad departments were represented at the meeting, men being present from the operating, telegraph, maintenance of way and electrical departments in addition to representatives of the signal departments.

On Friday, March 17, the members and guests of the association are invited to visit the Buffington, Ind., plant of the Universal Portland Cement Company. Transportation to and from the plant will be provided either with motor buses traveling over the boulevard and park system of Chicago or via a train leaving at 10 a. m. Luncheon will be served at the plant and the return trip made in time to reach the hotels at 3:30.

* * *

The Pittsburgh & Shawmut has recently awarded a contract to the Concrete Steel Bridge Company, Clarksburg, W. Va., for the construction of a reinforced concrete highway bridge at Colwell, Pa. The structure will be 220 ft. long with a 180-ft. span, 24 ft. wide and 110 ft. high. A contract has also been awarded to the Dwight P. Robinson Company, New York, for lining the Mauk tunnel with concrete.

* * *

The Northern Pacific is asking for bids for the installation of automatic block signals between Fargo, N. Dak., and Mandan, 151 miles of which is single track and 53 miles of double track, which will require 383 three-position upper-quadrant signals. This installation will be completed this summer and will constitute the last big gap not automatically block signaled between the Great Lakes and Puget Sound, a distance of about 2,227 miles.

* * *

Hjalmar Aberg, chief engineer, and Ture Hard, chief signal engineer, respectively, of the Swedish State Railways, are visiting the Railway Appliances Exhibit and the Signal convention in company with Hugo Wilson, chief engineer of the Switch and Signal Company of Sweden. Mr. Aberg and Mr. Hard are making an investigation of the application of automatic block signals to electrified track. An important feature of their tour of inspection was a study of the electrified lines of the Chicago, Milwaukee & St. Paul.

* * *

Members of the Santa Fe Signal Supervisors Committee, consisting of several officers of the signal department of the Santa Fe and former members of this organization, held their eighth annual luncheon at the Drake Hotel on March 13. Those present included T. S. Stevens, signal engineer system; L. Brown and G. K. Thomas, assistant signal engineers; H. Hobson, E. Hanson, E. Winans, signal engineers; G. R. Cowherd, signal engineer, E. P. & S. W.; B. T. Anderson, assistant signal engineer, D. L. & W.; H. K. Ferguson, president, The H. K. Ferguson Co.; P. B. Hyde, vice-president, General Battery Co.; J. S. Hobson, western manager, Union Switch & Signal Co., and J. E. Saunders, assistant chief engineer, Union Switch & Signal Company.

* * *

As an indication of the lively interest of the manufacturers of railway supplies in conventions being held by railway associations, it is of interest to note the action taken last Thursday and Friday in Pittsburgh, Pa., by the exhibit committee of the Railway Supply Manufacturers' Association. This committee definitely assigned and received payment for 91,000 sq. ft. of exhibit space on Young's "Million Dollar" steel pier at Atlantic City, out of a total of the 94,000 sq. ft. available for the June conventions of Section V, Mechanical Association; Section VI, Purchases and Stores; the A. R. A., and the semi-annual meeting of the Association of Railway Electrical Engineers. Two hundred and seventy-five exhibitors were given space, leaving only a few scattered spaces yet to be assigned. While some doubt was entertained initially as to the Machinery Hall being fully taken, all spaces in this section were definitely assigned.

Tickets for the annual dinner of the A. R. E. A., which will be held in the Gold room at 6:30, may be secured from W. A. Wallace of the Arrangements committee in the lobby back of the registration booth this morning. General R. C. Marshall, Jr., general manager, Associated General Contractors of America, Washington, D. C., and formerly chief of the Construction Division of the United States Army, will speak on "Some Needs of the Railroads"; Judge James A. Mulligan, Ottawa, Ontario, will discuss "Canada's Destiny," and Gus W. Dyer, Professor of Political Economy, Vanderbilt University, Nashville, Tenn., will talk on "Government and Business."

* * *

The St. Paul Sectional Committee of the Signal section, A. R. A., will hold its fifth meeting at Room 1110, in the Northern Pacific railway general office building, St. Paul, Minn., at 9:30 a. m., on Tuesday, March 28. Papers will be presented on the "Operation, Maintenance and Lubrication of Motor Cars," by W. E. Adams, president, Adams Motor & Mfg. Co.; "Armco Bond Wires for Signal Use," by Mr. McCune of the Page Steel & Wire Co.; "Grounds on Signal Circuits, Their Cause and Effects," by a representative of the General Railway Signal Company, and "Operation of Automatic Block Signals, Single and Double Track," by a representative of the Northern Pacific.

* * *

J. Beaumont, chief engineer for the Regan Safety Devices Company, Inc., interests abroad with offices in London and Paris returned to the United States on February 6, and was appointed vice-president and sales manager of this company, effective March 1. Mr. Beaumont's headquarters will be in Chicago. A. G. Shaver, chief engineer, has been appointed vice-president and chief engineer for this company, effective March 1, with headquarters at Chicago. B. W. Meisel has been promoted from engineer to resident engineer in the sales department, effective March 1. F. J. Le Preau, manager of the railroad department of the Macbeth-Evans Glass Company, has resigned to accept a position as resident engineer with the Regan Safety Devices Company, Inc., with headquarters for the present at Chicago. His appointment was effective March 12.

A. R. E. A. Program

The program of the American Railway Engineering Association for today is as follows, the morning session convening at 9 a. m. and the afternoon at 2 p. m.

V.	Track	Bulletin 243
XXIII.	Shops and Locomotive Terminals	Bulletin 241
I.	Roadway	Bulletin 241
XVI.	Economics of Railway Location	Bulletin 241
XVIII.	Electricity	Bulletins 239, 244
XI.	Records and Accounts	Bulletin 242
IX.	Signs, Fences and Crossings	Bulletin 242
XIII.	Water Service	Bulletin 242
XX.	Uniform General Contract Forms	Bulletin 242

Signal Section Committee Meeting

The following committees of the Signal section, A. R. A., will meet Wednesday morning at 9 a. m., in the offices of the Association, in the Manhattan Building, Chicago.

Committee V—Sub-Committee 2.

Committee II—Mechanical Interlocking.

Committee XIII—Electrical Testing.

Committee V—Maintenance Rules and Instructions—will meet on Thursday morning at the same office.

The A. R. E. A. in Session at the Congress Hotel Tuesday Afternoon

Railway Engineering Association Proceedings

Crowd at Opening Session Yesterday Morning Taxed Capacity of Florentine Room

ALL RECORDS OF attendance at an opening session of the conventions of the American Railway Engineering Association were broken yesterday when the meeting was called to order by President L. A. Downs, vice-president and general manager, Central of Georgia. Mr. Downs spoke briefly extemporaneously in lieu of a prepared address after which the reports of the secretary and treasurer were presented. The association then began the consideration of the reports of the various committees.

Reports were presented by the committees on Yards and Terminals, Economics of Railway Labor, Ballast, Iron and Steel Structures, Standardization, Signals and Interlocking, Ties and Stresses in Railroad Track.

Address of President Downs

WE ARE JUST ABOUT ready to pass the twenty-third milestone in the existence of the American Railway Engineering Association, and I am pleased and happy to advise you that we did not move backward during the past year. Our financial statement is good. I am pleased to advise you that we made all of our expenses and nearly $1,800 in addition, so that our financial affairs are in very good shape.

Our membership has increased. We received 129 new members into this association during the past year. That is on top of the big drive for membership made in the previous year when there were nearly 600 new members admitted, and we think that the record for last year is very gratifying. We now have a total of 1,960 members in the Association. We dropped an unusually large number of members the past year—115, on account of non-payment of dues, the largest number we have ever dropped, but the house was cleaned this year and we have now a good going organization. There were 16 deaths during the past year, among the members of our association, one being Col. Webb, of the Board of Direction, and another our first president, John F. Wallace.

We have continued our affiliations with the American Railway Association in a very creditable manner, and I take pleasure in announcing to you that this convention is a meeting of the Engineering Section of the American Railway Association, and our reports go to the American Railway Association. We have co-operated with other organizations during the past year, especially with the Joint Committee on Concrete and Reinforced Concrete of the American Society of Civil Engineers, and the American Society for Testing Materials.

We have continued our contact, or rather tried to, with the universities. Dean Potter of Purdue University has invited a committee from this association to visit Purdue and it is hoped that a meeting there will be held in the near future. The association has authorized the appointment of a committee to work out a means whereby a better contact with universities could be made. We are very mindful that such a thing is necessary. I regret to say, nothing has been done, but we expect something constructive to be accomplished during this coming year and we hope that something will be done. We need the universities and the universities need us.

I sent a questionnaire to 19 universities a short time ago—19 representative technical schools of the United States—to which I received 15 replies. Out of these 15 replies there were 12 that gave definite information as to their graduates. During the past 10 years, from 1911 to 1921, there were 3,003 graduates in civil engineering, and, surprising as it may seem, only 272 or 9 per cent are working for railroads. I did not find out how many of the men of the engineering departments of the railroads were graduates of engineering schools, but in the case of

two railroads, where I had a count made, that employed about 350 engineers, only about 50 per cent are graduates of technical schools. Something must be done to bring technical men into railroad work.

In the southeast, I made a canvass to discover what wages are paid to the young engineering graduate who desires to enter railroad work in the engineering department, and I found that the average salary is $118 monthly. I am not in sympathy with the so-called welfare work of another engineering society in its uplifting of wages, but I want to say that if the managers of the railroads of the United States want the services of trained men they must fix some attractive wage for college graduates to start on. When we pay a fireman $175 a month to start, a flagman $141, a switchman $181, a car repairer $143, and a graduate of a technical engineering school $118, there is something wrong with the principles of the wages paid on railroads. (Applause.)

The real test of the work of this association is what the railroads are doing with our reports. The real test of the good that we may do is whether they are put into use on the railroads. Every head of every railroad in the United States should put it up to the head of his engineering department and ask him if he is using the reports of the A. R. E. A. on the railroad and if he is not, to give a reason for not doing so. The answers to that question to the heads of the railroads will be constructive criticism, and our association will know its destiny by such reports. I thank you. (Applause.)

L. A. Downs
President

Report of the Secretary

Exhibit A, appended hereto, gives a detailed record of the receipts and expenditures, from which the following items are abstracted:

Receipts	$48,111.75
Expenditures	46,358.46
Excess of Receipts over Expenditures	$ 1,753.29
Total Cash Assets	$44,742.51

The following is a report on the present membership of the Association:

Membership March 1, 1921		1,951
Deceased members	16	
Resignations and dropped	115	
	—131	
Additions during the year	128	
Loss	3	
Total membership March 1, 1922		1,948

Deceased Members

The losses sustained by death during the year were:

F. E. Bissell, consulting engineer.

J. S. Browne, assistant to engineer maintenance of way, New York, New Haven & Hartford.

F. F. Busteed, ex-general superintendent, Canadian Pacific.

H. C. Ferris, receiver, Muskogee, Oklahoma & Gulf.

F. W. Leatherbury, division engineer, Gulf, Colorado & Santa Fe.

W. H. Given, operating department, Chicago, Rock Island & Pacific.

J. F. Keegan, general superintendent, Baltimore & Ohio.

G. C. Millet, assistant to chief engineer, Atchison, Topeka & Santa Fe, Coast Lines.

Major John W. Moore, assistant engineer, Illinois Central.

R. J. Parker, general manager, Atchison, Topeka & Santa Fe, Western Lines.

R. M. Pearce, resident engineer, Pittsburgh & Lake Erie.

C. W. Pifer, office engineer, U. S. Railroad Administration.

J. R. Savage, general superintendent, Long Island Railroad.

Colonel George D. Snyder, consulting engineer.

John Findley Wallace (past-president), chairman, Chicago Railway Terminal Commission.

Colonel George H. Webb (director), chief engineer, Michigan Central.

John Ehrke, assistant to general superintendent, Grand Trunk, Chicago.

C. H. Niemeyer, acting engineer maintenance on the Pennsylvania System, Williamsport, Pa.

The Revised Manual

Further time is requested in which to complete work on the revised Manual. Five hundred pages of the volume are already printed. It is now expected to have the Manual ready for distribution about June 1, 1922.

The recommendations adopted at the March, 1921, annual meeting of the American Railway Engineering Association—functioning also as the Engineering Division of the American Railway Association—were presented to the November, 1921, session of the latter organization for endorsement and a great many subjects received such endorsement by the American Railway Association.

Standardization

The American Railway Association has taken out membership in American Engineering Standards Committee, and designated a member of the Engineering Division to be its official representative on that body. E. A. Frink, chairman of the Standardization committee of the Association, has been appointed to act in that capacity, with J. R. W. Ambrose as alternate.

Among the matters now pending before the A. E. S. C., with the view of standardization, in which the Association is concerned, are the following: Railroad cross-ties and switch-ties, pipe flanges and fittings, steel railway bridge specifications, grading of lumber, testing of wood, steel forgings, bolt, nut and rivet proportions, steel shapes, insulated wires and cables, overhead crossing specifications, electrical symbols, electrical power control and aluminum for conducting purposes.

Amendments to Constitution

Two amendments to the Constitution were submitted to vote by letter-ballot during the year: (1) To amend Article V, Section 4, paragraph b, and (2) to amend Article VI, Section 2—the first amendment contemplating the inclusion of past or present members of the Board of Direction for eligible candidates for president and for vice-president; and the second amendment requiring the Nominating Committee to select two candidates for vice-president instead of one candidate.

Both amendments having received a majority number of those voting, the two amendments become effective immediately.

The vote on the two amendments is as follows:

For Amendment No. 1	658
Against Amendment No. 1	58
For Amendment No. 2	685
Against Amendment No. 2	31

Respectfully submitted,

E. H. Fritch, Secretary.

Exhibit A—Financial Statement for Calendar Year Ending December 31, 1921

Balance on hand January 1, 1921		$42,989.22
RECEIPTS		
Membership Account		
Entrance Fees	$ 1,970.00	
Dues	11,152.15	
Subscriptions to Bulletin	11,152.15	
Binding Proceedings and Manual	1,652.05	
Badges	15.00	
Sale of Publications		
Proceedings	4,406.11	
Bulletins	1,242.22	
Manual	32.80	
Specifications	539.35	
Leaflets	28.75	
General Index	4.50	
Advertising		
Publications	2,192.30	
Interest Account		
Investments	2,022.50	
Bank Balance	65.86	
Annual Meeting		
Sale of Dinner Tickets	1,212.00	
Miscellaneous	274.52	
American Railway Association		
Rail Committee	10,149.49	
Total	$48,111.75	
DISBURSEMENTS		
Salaries	$ 6,800.00	
Proceedings	9,566.26	
Bulletins	12,649.11	
Manual	76.05	
Stationery and Printing	670.18	
Rents, Light, etc.	845.00	
Telegrams and Telephone	37.83	
Supplies	188.36	
Expressage	875.96	
Postage	1,016.39	
Exchange	99.86	
Committee Expenses	77.18	
Officers' Expenses	22.27	
Annual Meeting Expenses	2,271.37	
Refunds Account Duplicate Payments	14.60	
Audit	150.00	
Reprints of Report Joint Committee on Concrete and Reinforced Concrete	325.00	
Rail Committee	10,308.20	
Miscellaneous	364.84	
Total	$46,358.46	
Excess of Receipts over Disbursements		$ 1,753.29
Balance on hand December 31, 1921		$44,742.51
Consisting of:		
Bonds	$40,565.65	
Cash in S. T. & S. Bank	4,151.86	
Petty Cash Fund	25.00	
	$44,742.51	

Stresses in Track Fund

Balance on hand January 1, 1921		$ 954.85
Received from interest during 1921		26.47
		$ 981.32
DISBURSEMENTS		
Transportation	$ 9.84	
Hotels and Meals	7.30	
Supplies	1.98	$ 19.12
Balance on hand in S. T. & S. Bank, December 31, 1921		$ 962.20

Respectfully submitted,

BOARD OF DIRECTION.

Report of the Treasurer

Balance on hand January 1, 1921		$42,989.22
Receipts during 1921	$48,111.75	
Paid out on audited vouchers, 1921	46.358.46	
Excess of Receipts over Disbursements		$ 1,753.29
Balance on hand December 31, 1921		$44,742.51
Consisting of:		
Bonds	$40,565.65	
Cash in S. T. & S. Bank	4,151.86	
Petty Cash Fund	25.00	
	$44,742.51	

Stresses in Track Fund

Balance on hand January 1, 1921		$ 954.85
Received from interest during 1921		26.47
Total		$ 981.32
Paid out on audited vouchers, 1921		19.12
Balance on hand December 31, 1921		962.20

The securities listed above are in a safety deposit box of the Merchants' Loan & Trust Safe Deposit Company, Chicago.

Respectfully submitted,

GEO. H. BREMNER, Treasurer.

Report on Yards and Terminals

In constructing warehouses in connection with l. c. l. freight houses some handicaps may be obviated by organizing a subsidiary company or by leasing to an independent company. It is desirable to eliminate interference between employees and patrons, and this can be done by providing separate facilities for each. The container system for l. c. l. freight shows many possibilities for economical operation. It is believed that no revisions are necessary in the present recommended hump grades in classification yards, and that in many of the hump yards now in existence, a departure yard is not required, while in many others its justification is problematical.

A. Montzheimer
Chairman

A. Montzheimer is completing his first year as chairman, having been vice-chairman for three years, prior to which he had been a member of the committee for 14 years. He has been chief engineer of the Elgin, Joliet & Eastern for 19 years. As this road is primarily a belt and switching line, Mr. Montzheimer has been brought intimately into contact with terminal operations on his own road and through observation with those on connecting lines. He is therefore particularly well qualified to direct the work of this committee in the investigation of subjects which are receiving so much attention from railway officers today.

In Appendix A, the committee submitted a report on the handling of freight, etc. A report was also submitted on classification and departure yards in Appendix B.

Conclusions

1. The committee recommended the following definition for insertion in the Manual:

Sorting Yard.—A yard in which cars are classified in greater detail after having passed through a classification yard.

2. The committee recommended that its reports be received as progress reports.

Committee: A. Montzheimer (E. J. & E.), chairman; Hadley Baldwin (C. C. C. & St. L.), vice-chairman; J. E. Armstrong (C. P. R.), F. J. Ackerman (K. C. Term.), J. H. Brinkerhoff (N. P.), J. D'Esposito (Chi. Union Sta.), A. W. Epright, Reuben Hayes (Sou.), J. B. Hunley (C. C. C. & St. L.), F. E. Morrow (C. & W. I.), O. Maxey (C. R. I. & P.), H. J. Pfeifer (St. L. Term. Assoc.), C. E. Smith (Cons. Engr.), C. H. Spencer (I. C. C.), E. E. R. Tratman (Engr. News Record), C. A. Briggs, Miles Bronson (N. Y. C.), A. E. Clift (I. C.), L. G. Curtis (B. & O.), H. T. Douglas, Jr. (C. & A.), E. M. Hastings (R. F. & P.), L. J. F. Hughes (C. R. I. & P.), D. B. Johnston (Penna.), B. H. Mann (M. P.), C. H. Mottier (I. C.), S. S. Roberts (Cons. Engr.), J. G. Wishart (C. R. I. & P.).

Appendix A—Warehouses in Connection With L.C.L. Freight Houses

Some of the principal advantages of constructing warehouses in connection with l. c. l. freight houses may be briefly stated as follows:

(1) The development of the air rights above the freight house for warehouse purposes creates an added source of revenue which helps reduce the charge for high land values which would otherwise be absorbed entirely by the freight house.

(2) The warehouse, by being located on the railroad company's property, attracts traffic to the railroad which might otherwise be lost.

(3) The occupant of the warehouse is saved the usual time and expense necessary to truck his goods between warehouse and freight station. In many locations, where streets are narrow and already congested with traffic, this elimination of trucking is desirable, both from the standpoint of the warehouse operator and the municipality.

Some of the principal disadvantages of constructing warehouses in connection with l. c. l. freight houses may be expressed as follows:

(1) There might be created by this arrangement considerable interference between the employees and patrons of the warehouse and those of the freight station, which would be objectionable.

(2) Railroads are not organized to conduct a warehouse business and some of them are legally restricted from engaging in such activities.

(3) A warehouse operated by a railroad company is governed by the regulations of the Interstate Commerce Commission, which is not the case with a privately operated warehouse company. This places the railroad company on an unfavorable competitive basis with the private company.

In numerous cases the last two handicaps have been overcome by the railroad company by either organizing a subsidiary warehouse company to operate the property or leasing it for a period of years to an independent company.

If a warehouse is to be operated most successfully in connection with an l. c. l. freight house, particularly if the latter is of some magnitude, it is desirable to eliminate interference between employees and patrons of the two facilities. It is, therefore, desirable in so far as possible, without a too great duplication, to provide separate and independent facilities for each. This applies particularly to tailboard space, railroad trackage, shipping platform space and elevator service. Adequate facilities should be provided for the warehouse without interfering with the freight house operation. To do this, it is necessary to determine the amount of trackage, tailboard space, shipping platform area and elevator service required for a given warehouse floor area.

Elevators—The question of amount of warehouse space per elevator is one which does not admit of a definite solution and a very great variation might, therefore, be expected. The more recent installations have elevators with a capacity of four trucks, which requires an elevator platform approximately 9 ft. by 17 ft. It is also evident that the capacity of elevators in pounds has been increased in proportion to their size. There has also been a tendency to increase the speed, but as an increase in speed very materially increases the cost of elevators the progress in this direction has not been as rapid as in the size and capacity.

In arriving at a suggested area of warehouse floor space per elevator, it is assumed that elevators will be installed of a size sufficient for four trucks, with a corresponding capacity and speed as dictated by modern warehouse practice, which seems to be a capacity of 10,000 lb. per elevator and a speed of 150 ft. per min.

Shipping Platform Space—By shipping platform space is meant the area of platform adjacent to the railroad siding used exclusively for warehouse shipping. In numerous warehouses this space is made larger than required for shipping purposes in order to provide a small amount of storage space which, under certain conditions, is very desirable. The amount of space actually required in proportion to the total storage area of the warehouse depends largely on the extent to which the warehouse is supplied by rail.

From the data available it would appear that an allowance of 4 per cent would be ample and should allow some space on platform for storage purposes. The information would indicate that 3.5 per cent might be considered a reasonable minimum allowance.

The Amount of Railroad Car Trackage—The amount of trackage required depends upon the extent to which the warehouse is supplied by rail and whether the shipments are from rail to rail or from rail to team or rail to boat. It is evident that the trackage requirements should be the greatest when shipments are from rail to rail. The length of turnover also influences the amount of trackage required.

Tailboard Frontage—The amount of tailboard space is dependent upon the frequency of turnover and the extent to which teaming is used as a means of handling goods to and from the warehouse. It would appear from figures presented and observation of the warehouses that an allowance of 1,100 sq. ft. of warehouse floor space per foot of tailboard frontage is reasonable. If we use this figure and the suggested 17,600 sq. ft. of storage space per railroad car, it follows that 16 ft. of tailboard frontage should be provided per car.

Summary—Summarizing the foregoing report as to the suggested relation between the various factors of design, we have the following, which are suggested for warehouses where the turnover of goods is moderately rapid.

(1) One elevator should be provided for each 40,000 sq. ft. of warehouse space served.

(2) The shipping platform area should be 4 per cent of warehouse storage floor area.

(3) There should be one car length of track siding for each 17,600 sq. ft. of warehouse storage area.

(4) There should be one foot of tailboard frontage for every 1,100 sq. ft. of warehouse storage area.

(5) There should be 16 ft. of tailboard frontage for each car length of siding.

The above figures do not represent exact limits of design, but are indicative of the proper relation which should exist based on experience of the warehouses studied in this report. An idea of the permissible variation from these figures may be obtained by a review of the foregoing tables.

Handling L. C. L. Freight by the Container System

In the handling of freight by mechanical means a recent development is the use of the container system for moving l. c. l. freight in lots between certain points. This system has been applied mainly to the transfer of freight in cities, but is used also in its transportation between cities. In both cases possibilities have been

developed in economy in time, cost, use of cars and freight house space.

City Transfer of L. C. L. Freight—The committee outlined the systems in use in Cincinnati and St. Louis and on the Chicago, Northshore & Milwaukee.

Inter-City Transfer of L. C. L. Freight—An experiment with railway transportation of freight and express in containers was begun early in 1921 by the New York Central Railroad but no regular service has been established. This system is being tried for handling freight between Cleveland and Chicago, and mail and express matter between New York and Chicago.

Container Systems on Foreign Railways—Both motor-truck and tractor-trailer container systems have been introduced by several European railways, largely for the store-door delivery service which is common in Europe. The railroad transportation of containers has been used by English railways for some years, particularly in handling mails, baggage and parcels where steamer transfer is involved, as on routes to France and Ireland.

Appendix B—Classification Yards, Including Methods of Switching From Classification Yards to Departure Yards

A questionnaire in regard to details of design and operation was sent to the railways which had constructed hump yards since the list appearing on page 133 of Volume 15 of the Proceedings was compiled, and a further questionnaire in regard to methods of switching from classification to departure yards, and in regard to the utility of sorting yards auxiliary to classification and departure yards, for more detailed classification of cuts, was sent to these railways as well as to all of the railways previously listed. A further investigation on the part of the sub-committee indicates that the Peoria & Pekin Union has converted its East Peoria hump yard to a flat yard; that the Nashville, Chattanooga & St. Louis has temporarily abandoned hump operation at Atlanta, and that the Kentucky & Indiana Terminal has abandoned hump operation in its Youngstown Yard at Louisville. Further revisions necessary to bring the list on page 133 of Volume 15 of the Proceedings up to date, in so far as the committee now has information, are the addition of:

Name of Railway	Location of Hump Yard
Canadian Pacific	Fort William
	Winnipeg City
	Calgary
	Vancouver
Central Railroad of New Jersey	Penobscot, Pa.
Illinois Central	Markham (near Chicago)
Louisville & Nashville	DeCourcey (near Cincinnati)
Michigan Central	Niles
New York, New Haven & Hartford	Cedar Hill
	Providence
Norfolk & Western	East Portsmouth
	Williamson
	West Roanoke
Pennsylvania System	Cape Charles
	Renova
	Hawthorne (near Indianapolis)

Hump Yard Design and Operation

An analysis of the information received leads the sub-committee to believe that no revisions are necessary in the present recommended hump grades. Although it is probable that these precise grades cannot be used in any given instance, they are a guide as to the grades which will probably be required under given conditions and, if installed, can readily be altered, as may be necessary to meet the exact conditions of any given climate or traffic.

The sub-committee believes that where it is possible economically to construct a classification yard of sufficient length and number of tracks to permit of using it as a departure yard without interfering materially with its operation as a classification yard, a departure yard is not required and is an undesirable addition to the layout. When the volume of traffic is such as to require the constant use of the maximum economical classification yard, or when the tracks in the classification yard are shorter than the usual road train and cannot or should not be extended, a departure yard for the purpose of combining short cuts from several classification tracks into a single road train, and for the purpose of storing this road train during the interval between its assembly and the time of its departure, is of very great advantage in relieving congestion in the classification yard and in minimizing terminal delays. When a departure yard has been installed it may also be economically used for a certain amount of additional sorting of cars by flat switching after they have had a preliminary classification over the hump. It should not, however, be installed primarily for this purpose.

When the amount of business will not permit of re-humping cars, relief may be secured by building a flat sorting yard so located that cuts may be pulled from the classification yard by a sorting engine, resorted into these tracks, reassembled, and moved directly into the departure yard. If in any case the amount of re-sorting to be done should attain such magnitude that flat switching in this manner is no longer economical, a second hump yard tributary to all or any part of the classification yard and located between the classification yard and the departure yard in such a manner as to permit of re-humping cars without interfering with the operation of the main hump might be considered. The number and length of tracks required in a sorting yard depends upon the amount of resorting to be done and the number of secondary classifications to be made.

Based upon the information now in hand the sub-committee believes that in many of the hump yards now in existence a departure yard is not required, and that only in isolated cases where a departure yard is used, would a sorting yard be an economical adjunct.

Conclusions

The sub-committee is not yet prepared to make a definite recommendation as to when a departure yard, or a sorting yard for intermediate switching between the classification and departure yard is required, but submits the foregoing as information.

The sub-committee believes that no alterations should be made at the present time in the hump grades as now recommended.

Discussion

The report was presented by Chairman Montzheimer and the chairman of the sub-committees. Mr. Montzheimer presented the conclusions as given at the head of the report, *and his motion that they be adopted was carried.*

Chairman Montzheimer: I do not know of any subject that is more important to the railroads of this country than the question of reduction in the preparatory time and the leaving time of trains at terminals. It is a well known fact that there is a lot of time lost from the time the crew is ordered until they get out of the yard, and if the committee can go into the subject and present something that will be of value to this association, I think it will be well worth the time that we put in on the subject.

E. H. Lee (C. & W. I.): This is really a very important question, and I am very glad to see that the committee intends to devote some attention to this particular angle of the terminal situation during the coming year.

The speaker quite a number of years ago had occasion to investigate this precise question and some very astonishing results were developed at that time both to the men who made the investigation and to the men who were operating the railroads. I think our association is particularly well qualified to develop a great many of the fundamental facts on perhaps a great many railroads that many of the engineers, as well as operating men, do not at this time seem to understand.

R. G. Kenly (M. & St. L.): It is the function of this association so to design the engine lead from the house to the departure yard, or vice versa coming in, that it will take into consideration the question of facilities for pumping up car line car inspection. I think it would be very pertinent if the functions of this committee can be enlarged to take care also of a little bit of the road facility. It has always been my idea that even the poorest of our railroads ought to have a bit of second track extending through its most important yards, and at least, far enough out into the country for the despatcher to get hold of his trainmen.

E. R. Lewis (M. C.): I would like to ask a little further consideration from the committee on subject No. 6, Transfer of laden bad order cars.

(The committee was excused with the thanks of the Association.)

Report of the Committee on Ballast

Time studies of track raising on stone and gravel ballast were utilized in the preparation of diagrams showing the organization and distribution of small ballast gangs. Detailed figures are given on the costs of ballasting, showing the time required as reduced from reports of representative railroads. Old style wooden "D" shovel handles are believed to be uneconomical because of breakage and the waste of material in manufacture. Neither are malleable "D" handles entirely satisfactory. The committee submitted designs for handles as information; and recommended the inclusion in the Manual of specifications for ballast shovels and a design of spot board.

F. J. Stimson
Chairman

F. J. Stimson is rounding out his first year as chairman, after serving as vice-chairman for one year. He has been a member of the committee for 16 years. Mr. Stimson was appointed chief engineer maintenance of way of the Southwestern Region of the Pennsylvania System on the reorganization of that road, which position he has held since March 1, 1920, prior to which time he was a division superintendent for several years. From over 25 years' experience in the maintenance engineering corps of the Grand Rapids & Indiana, during ten years of which time he was roadmaster he has acquired a thorough acquaintance with ballast problems.

In Appendix B the committee submitted data received from various railroads compiled as far as practicable in uniform statements; also diagrams showing the proposed organization and distribution of men in a small emergency ballast raising gang (1) for stone ballast and (2) for gravel ballast. Appendix C gives proposed specifications for track shovels, suggested plans for different types of shovel handles and a plan for a Spot Board.

Conclusions

1. The committee recommended that there be added to the Manual the following definition:

Spot Board—A sighting board laid across the rails in advance of a raising gang to govern the amount of raise and insure uniform grade line.

2. The committee recommended:

(a) That the diagrams in Appendix B be approved as recommended practice and printed in the Manual.

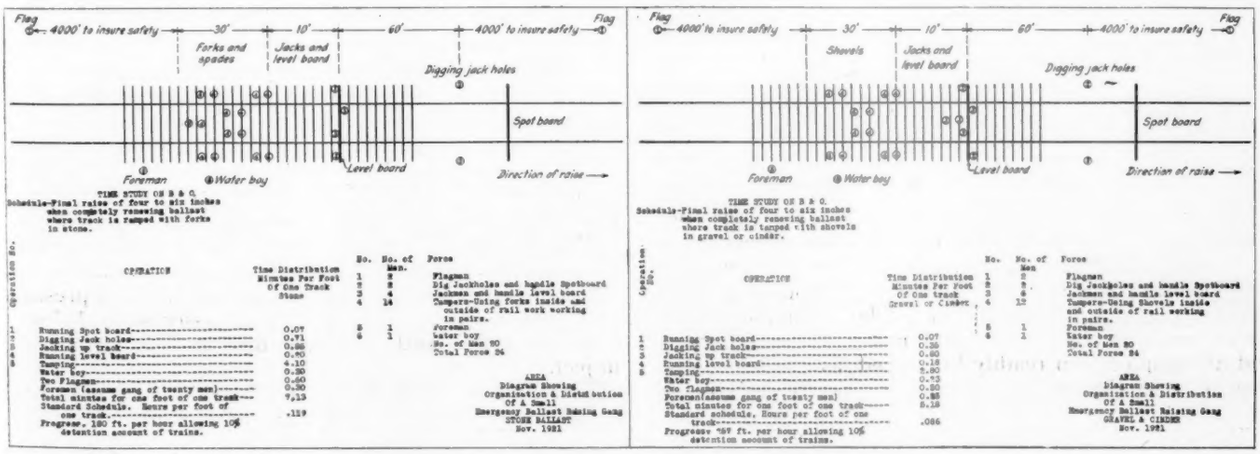
(b) That the matter referring to cost of ballast be accepted as information and the subject continued.

3. The committee recommended:

(a) That the specifications for ballast shovels shown in Appendix C be approved as recommended practice and printed in the Manual.

(b) That the plans of track shovels as shown in Appendix C be accepted as suggestions for trial and that the subject of the design of track shovel be continued.

(c) That the plan of Spot Board as shown in Appendix C be approved as recommended practice and printed in the Manual.

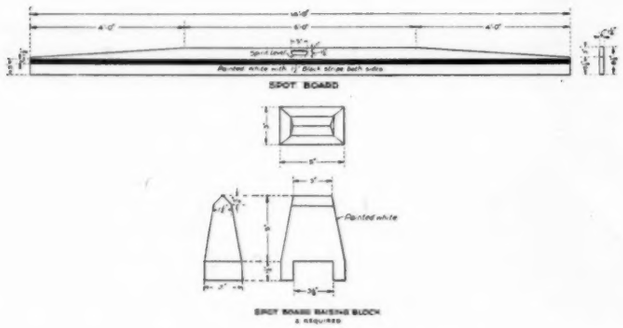


Recommended Practice for Organizing Ballast Gangs

Committee: F. J. Stimson (Penna.), chairman; G. H. Harris (M. C.), vice-chairman; C. W. Baldridge (A. T. & S. F.), O. F. Barnes (Erie), Theo. Bloecher, Jr. (B. & O.), H. E. Boardman (N. Y. C.), C. J. Coon (Grand Cent. Term.), C. E. Dare (W. S.), H. M. Doughty (D. L. & W.), Paul Hamilton (C. C. C. & St. L.), A. G. Holt (C. M. & St. P.), F. A. Jones (M. P.), J. S. McBride (C. & E. I.), H. L. Ripley (N. Y. N. H. & H.), F. R. Ramsey (T. St. L. & W.), Hans Schantl (M. R. & B. T.), M. A. Stainer (F. W. & D. C.), Paul Sterling (N. Y. N. H. & H.), D. W. Thrower (I. C.), P. H. Winchester (N. Y. C.), Lef Winship (M. P.).

Appendix B—Application of Ballast

From time studies of raising track on both stone and gravel ballast, which were made available by the Baltimore & Ohio, diagrams were prepared showing the organization and distribution of small ballast gangs for the two classes of ballast, stone and cinders or gravel.



Details for a Standard Spotboard

It is considered that so far as application is concerned cinders and gravel will require the same kind of gangs. The diagrams as presented are recommended for adoption as recommended practice.

Cost of Ballasting

A form which was prepared and sent out the early part of last year, asking for reports of the costs of ballasting in detail, brought replies from four railways.

Table No. 1—A, B, C, D and E, give the figures taken from the reports which were returned in the form asked for by the committee.

Table I-A—Time Required and Cost of Skeletonizing Track per Cubic Yard of Material Removed

Railway	Single or Double Track	Kind of Material	Number of Men in Gang		Time Removing Material From		
			Foremen	Men	Crib	Center Ditch	Shoulder
6	Cleaning Double....	Stone..	1	13	70 min.	53 min.	53 min.
7	Ballasting Double....	Gravel	1	11	25 min.	20 min.	18 min.
8	Ballasting... Single.....	Dirt...	2	13	49 min.	52 min.	6 min.

Depth Cut	Cu. Ft. Material Removed Per Foot of Track		No. Linear Ft. Track Per Yd. Material	Total Time Per Yd.	Time Lost	Cu. Yds. Per Mile	Total Time Per Ft.	Total Time Per Mile Hours
	Double	Single						
10 in.	23	.....	2.5	176 min.	10%	.....	.....	9356
9 in.	11	.....	2.45	63 min.	.....	2135	.....	5544
.....	.....	3.76	7.18	101 min.	.....	735	.....	1204

Table I-B—Time Required and Cost of Unloading Ballast per Car Load

Railway	Kind of Ballast	Kind of Car	Plow or Drag	Number of Men		TIME	
				Foremen	Men	Placing Plow or Drag	Releasing Bottoms
6 Cleaning Ballast	Stone..	Hopper..	Drag....	1	17	5 min.	8.3 min.
7 Ballasting.....	Stone..	Hopper..	Drag....	1	10	4 min.	4 min.
8 Ballasting.....	Gravel	Rog. Bal	Tie-drag.	2	15	4 min.	1.5 min.
9 Ballasting.....	Chats.	Rog. Bal	Tie-drag.	1	8	0.5 min.	6 min.

TIME				Yards Per Car	Linear Ft. Track Per Yard	Yards Per Mile	Total Time Per Car	Total Hours Per Mile
Placing Stay Post	Shoveling Down	Winding Up	Lost					
8 min.	140 min.	8 min.	266 min.	30	3.3	2685	435 min.	645
2 min.	5 min.	5 min.	.....	38	1.44	3152	20 min.	75
.....	120 min.	20 min.	25 min.	25	2.7	1950	195.5 min.	254
.....	27 min.	8 min.	93.5 min.	.....	3.47	1520	135 min.	90

Table I-C—Time Required and Cost of Placing Ballast per Linear Foot of Track

Railway	Kind of Ballast	No. of Men		Average Height First Raise	Running Spot Board	Digging Jack Holes	Jacking Up Track
		Foremen	Men				
6 Cleaning Ballast	Stone..	1	14	3 in.	1.66 min.	2.1 min.	4.66 min.
7 Ballasting.....	Stone..	1	40	12 in.	0.5 min.	0.5 min.	2.0 min.
8 Ballasting.....	Gravel	3	18	6 in.	0.21 min.	0.42 min.	1.0 min.
9 Ballasting.....	Chats.	2	87	4 in.	0.024 min.	0.24 min.	0.48 min.

Running Level Board	Forking and Tamping	Water Boy	Flag and Protection	Foremen	Total Time Per Linear Foot	Amount of Interference	Hours Per Mile
4.1 min.	9.3 min.	0.9 min.	5.91 min.	3.8 min.	28.96 min.	8.5%	2549
0.5 min.	14.5 min.	0.5 min.	1.0 min.	0.5 min.	20. min.	.....	1760
0.21 min.	4.30 min.	.....	.....	.....	6.14 min.	.....	540
0.20 min.	9.136min.	0.36 min.	.....	0.24 min.	10.68 min.	.....	940

Table I-D—Time Required and Cost of Dressing Ballast per Linear Foot of Track

Railway	Single or Double Track	Kind of Material	No. of Men		Building Shoulder	Lining Edge of Ballast
			Foremen	Laborers		
6 Cleaning Ballast	Double..	Stone.....	1	9	6 min.	6 min.
7 Ballasting.....	Double..	Stone.....	1	11	3.75 min.	2.5 min.
8 Ballasting.....	Single...	R. Gravel.	2	9	2.90 min.	1.18 min.
9 Ballasting.....	Single...	Chats.....	1	56	2.40 min.	1.8 min.

Dressing Between Rails	Dressing Center Ditch	Moving Surplus Ballast	Foremen	Total Time Per Linear Foot	Delays	Total Man-Hours Per Mile
4.9 min.	4.9 min.	8.0 min.	3.21 min.	20.89 min.	11%	1842
1.375 min.	1.375 min.	5.0 min.	1.25 min.	14.5 min.	.....	1276
1.10 min.	.....	1.45 min.	1.72 min.	8.35 min.	.....	735
3.0 min.	.....	1.20 min.	0.15 min.	8.55 min.	.....	752

Table I-E—Recapitulation—Cost of Ballasting Cost per Mile Expressed in Pay-Roll Hours

Railway	Kind of Ballast	Single or Double Track	Kind of Cars	Hours Skeletonizing Track	Unloading Ballast
6 Clenning....	Stone.....	Double.....	Hopper.....	9474	826 hr.
7 Ballasting...	Stone.....	Double.....	Hopper.....	1529	75 hr.
8 Ballasting...	R. Gravel...	Single.....	Rog. Bal....	634	254 hr.
9 Ballasting...	Chats.....	Single.....	Rog. Bal....	1204	90 hr.

First Raise	Unloading Ballast	Second Raise	Dressing Ballast	Lining Track	General Supervision	Total Hours Labor	Work Eng. Hours	Train Car Hours
3003 hr.	890 hr.	830 hr.	1981 hr.	461 hr.	178 hr.	16972	73.1	91.6
1760 hr.	80 hr.	600 hr.	1276 hr.	80 hr.	150 hr.	5550	25.0	550.0
540 hr.	.....	.....	735 hr.	.....	16 hr.	2170	21.0	462.0
940 hr.	.....	440 hr.	753 hr.	80 hr.	10 hr.	2313	12.0	40.0

Recapitulation

Cost per mile of single and double track.
(1) One raise, giving from four to six inches of ballast under ties.

Ballast Delivered in	100,000-lb. Gondolas		100,000-lb. Hoppers		Roger Ballast Car	
Item	Single	Double	Single	Double	Single	Double
Stripping track	732	1667	732	1667	732	1667
1—Unloading ballast	186	460	34	87	22	51
Raising track	866	1732	866	1732	866	1732
2—Unloading ballast	186	460	34	87	22	51
Dressing ballast	1225	1468	1225	1468	1225	1468
Total	3195	5787	2891	5041	2867	4969
			Payroll Hours			
Plus W. T. Service in 8-hr. days	5.2	12.8	1.0	2.4	1.6	3.8

Cost per mile of single track and double track.
(One) Two raises, giving from 10 to 12 inches of ballast under ties.

Ballast Delivered in	100,000-lb. Gondolas		100,000-lb. Hoppers		Roger Ballast Cars	
	Single	Double	Single	Double	Single	Double
Stripping track	732	1667	732	1667	732	1667
1—Unloading ballast	186	460	34	87	22	51
1—Raising track	523	1045	523	1045	523	1045
2—Unloading ballast	186	460	34	87	22	51
2—Raising track	866	1732	866	1732	866	1732
3—Unloading ballast	186	460	34	87	22	51
Dressing ballast	1225	1468	1225	1468	1225	1468
Total	3904	7292	3448	6173	3412	6065
			Payroll Hours			
Plus W. T. Service in 8-hr. days	7.8	19.2	1.5	3.6	2.4	5.7

The costs of ballasting given above, are the bona fide figures presented by representative railways of the United States of America and of Canada, and are offered to the association as information.

Appendix C—Ballast Tools

The report of the committee presented to the 1921 convention included a suggested design for a track shovel. The sub-committee during the past year investigated the matter of handle design with special reference to the "D." It is found that the old style wooden "D" handle requires in its manufacture a large waste of material and also is very apt to be broken in use, thereby resulting in the loss of the entire shovel unless some other form of "D," which can be applied to a handle with a broken "D," is available. The malleable iron "D" as furnished in the past has not been altogether satisfactory, largely, it is felt, because of the metal spool or hand hold.

With a view to developing the utility and practicability of "D's" which can be applied to handles without "D's" the committee has prepared the designs which are shown herewith. It is hoped that the types of handles shown will be tried out and the committee will be able to secure information which will enable it to recommend a definite design.

The sub-committee has also prepared a design for a spot board with the necessary holders and raising blocks. This follows the design which is quite generally used on various railroads and is recommended for adoption as recommended practice and inclusion in the Manual.

Specifications for Ballast Shovels

Scope.—1. These specifications cover ballast shovels.

Material.—2. Blades shall be open hearth, crucible or alloy steel.

3. Straps shall be of softer steel than blades.

4. Handles shall be smooth and properly seasoned of the best grade straight, grained, commercial XX second growth, northern ash.

Design.—5. The dimensions of shovels shall conform to plans which are made a part of these specifications.

6. Carbon steel blades shall be not less than No. 13 gage and alloy blades shall be not less than 14 gage U. S. standard.

7. The straps shall be one gage heavier than the blade and rolled down to one gage lighter at the extreme and farthest end and shall be welded or riveted to the blade.

8. The straps shall be pressed flush with the handle. All the rough edges pressed down to uniform surface with the other parts of the handle and fastened to the handle by three rivets, the edges of which shall be pressed down flush with the surface of the straps.

Physical Properties.—9. Shovels shall be made in a workmanlike manner and free from all defects. The handles shall be bent to shape and free from knots, shake, wane or worm holes.

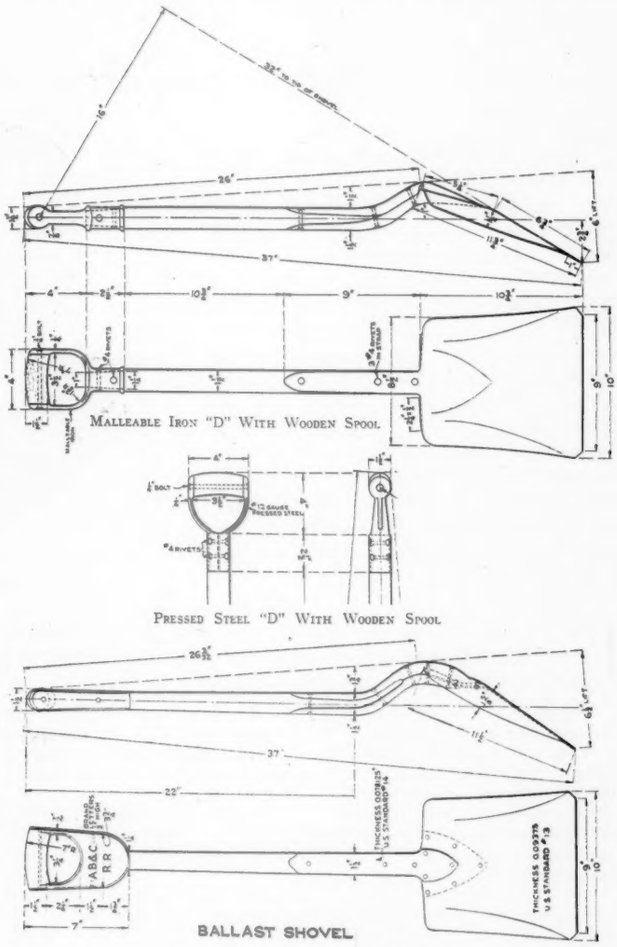
10. The blades shall be of natural color and coated with a high proof rust preventative and the entire strap shall be polished.

11. Blades shall show a Brinell hardness of not less than 300, readings to be taken anywhere on the blade, and the Brinell readings shall not show greater than 400 in a carbon blade or 470 in an alloy blade.

12. The shovel as a whole shall not be deformed permanently more than ½ inch of its lift after six 2-minute applications made at 2-minute intervals of the following test:

The point of the blade shall rest on a support; at a point 10½ inches from the edge of the blade, a chain shall be passed over the heel of the blade and drawn up and blocked with no slack and to be fastened to an eye-bolt in the floor; a ratchet jack standing on a platform scale shall be placed under the "D" of the handle and the jack pumped until 175 lb. (plus the weight of the jack and the paraphernalia used in making the test) is registered on the beam of the scale.

13. The manufacturer's name, quality of the steel and the date of manufacture shall be stamped plainly on the back strap and the name of the railroad shall be stamped on the front strap of each shovel.



Details for Standard Shovels

Inspection.—14. For the Brinell test and the test of strength, the inspector shall select at random one shovel from every ten dozen of each type purchased and should this shovel fail to meet the requirements in paragraphs 11 and 12, two more shovels shall be selected from the ten dozen and both must meet the specification requirements.

15. Inspection of tools shall ordinarily be made at the place of manufacture. The manufacturer shall notify..... of the railroad company at least.....days in advance when shovels will be ready for shipment.

16. The manufacturer shall allow the railroad company's inspectors such access to the work as may be necessary to satisfy them that the provisions of these specifications are carried out.

17. The manufacturer shall furnish, without charge, all necessary facilities, and assistants, for making thorough inspection and tests at the works.

Rejection.—18. Individual tools, defective in any respect, and lots of tools not meeting the above requirements, shall be rejected.

Discussion

(The report was presented by Chairman Stimson, who moved the adoption of the definition for "spot board." The motion was carried. C. W. Baldridge (L. A. T. & S. F.) as chairman of the sub-committee on application of ballast, presented Appendix B and moved the adoption of the chart on gang organization. The motion was carried. A. G. Holt (C. M. & St. P.) as chairman of the sub-committee on ballast tools presented Appendix C.)

Chairman Stimson: While the recommendation of the committee is to the effect that the specifications for ballast shovels shown in Appendix C be approved as recommended practice and printed in the Manual, it has seemed best to make these specifications in the nature of information instead of recommended practice, *I therefore move that the specification for ballast shovels in Appendix C be accepted as information.*

(Upon a question by President Downs it developed that the Ballast committee had not conferred with the Track committee with respect to the shovel designs, with the result that two designs were submitted.)

E. A. Frink (S. A. L.): It seems to me that both the specification and the design for shovels is exactly in the proper shape for presentation to the American Engineering Standards committee. *I move to amend the motion before the house by substituting this motion: That the design and specifications for shovels prepared by this committee on Ballast be presented to the American Engineering Standards committee for their procedure.*

(The motion as amended was carried and the committee was dismissed.)

Report on Iron and Steel Structures

Three changes are recommended in the general specification for steel railway buildings, 1920. Specifications for the erection of steel bridges are submitted for information. These specifications cover the erection of fixed spans less than 300 ft. long and include terms, materials, bearings, equipment, etc. The committee also submitted specifications for movable railway bridges, with specific and detailed rules for the design and manufacture of such structures as a guide to the designers and the shops. The specifications are based on the best general practice in the accepted types now in use on standard American and Canadian railways.

O. E. Selby
Chairman

O. E. Selby is completing his fifth year as chairman and his eleventh year as a member of the committee. Prior to his appointment as chairman he served for five years as vice-chairman. With the exception of one year he has been connected with the engineering department of the Cleveland, Cincinnati, Chicago & St. Louis and its subsidiary, the Louisville & Jeffersonville Bridge Company since 1890 and has been bridge engineer since 1905, taking over additional duties when he was appointed principal assistant engineer in 1915. He is a man of a scientific turn of mind with an active interest in organized technical work among engineers.

IN THE GENERAL SPECIFICATIONS for Steel Railway Bridges, 1920, three changes are recommended for adoption and printing in the Manual:

Article 47—Change the last sentence to read: "The unit stresses specified in Article 38 may be increased one-third for a combination of the secondary stresses with the *other* stresses, *but the section shall not be less than that required when secondary stresses are not considered.*"

Article 48—Change to read: "The gross area of the compression flanges of plate girders *and rolled beams* shall not be less than the gross area of the tension flanges, but the stress per square inch shall not exceed

$$16000 - 150\frac{l}{b}, \text{ in which}$$

l = the length of the unsupported flange between lateral connections or knee braces.

b = the flange width."

Article 243—Omit all of the fourth sentence after the word "Engineer," making the Article read:

Eye-Bars.

243. Eye-bars shall be straight, true to size, and free from twists, folds in the neck or head, and other defects. The heads shall be made by upsetting, rolling or forging. Welding will not be allowed. The form of the heads will be determined by the dies in use at the works where the eye-bars are made, if satisfactory to the Engineer. The thickness of the head and neck shall not overrun more than $\frac{1}{32}$ in. for bars 8 in. or less in width, $\frac{1}{16}$ in. for bars more than 8 in. and not more than 12 in. in width, and $\frac{3}{32}$ in. for bars more than 12 in. wide.

The committee, in Appendix A, submitted Specifications for the Erection of Steel Railway Bridges as information, but following the practice of the committee with respect to other important specifications in the past, desires that they appear in bulletin form for a year or so that the committee may get the benefit of a trial and discussion by users. In Appendix B, the committee submitted Specifications for Movable Railway Bridges as a conclusion for printing in the Manual. The statement in the appendix gives the history of their development. The committee believes them to be the best specifications for movable bridges now available.

Committee: O. E. Selby (C. C. C. & St. L.), chairman; P. B. Motley (C. P. R.), vice-chairman; F. Auryansen (L. I.), J. A. Bohland (G. N.), W. S. Bouton, A. W. Carpenter (N. Y. C.), M. F. Clements (N. P.), J. E. Crawford (N. & W.), O. F. Dalstrom (C. & N. W.), F. O. Dufour (Stone & Webster), Thos. Earle (Beth. Steel Brg. Corp.), W. R. Edwards (I. C. C.), C. R. Fickes (C. B. & Q.), G. A. Haggander (C. B. & Q.), R. L. Huntley (U. P.), B. R. Leffler (N. Y. C.), P. G. Lang, Jr. (B. & O.), Albert Reichmann (Am. Brg. Co.), O. B. Robbins, A. F. Robinson (A. T. & S. F.), H. N. Rodenbaugh (F. E. C.), W. R. Roof (C. G. W.), J. M. Salmon (L. & N.), I. L. Simmons (C. R. I. & P.), I. F. Stern (Cons. Engr.), H. B. Stuart (G. T.), G. E. Tebbetts (Roberts & Schaefer), F. E. Turneaure (Un. of Wis.), Dr. J. A. L. Waddell (Cons. Engr.), S. T. Wagner (P. & R.), H. T. Welty (N. Y. C.).

General Specifications for the Erection of Steel Railway Bridges

(For Fixed Spans Less Than 300 Ft. in Length)

Definitions of Terms.—1. The term "Engineer" refers to the chief engineer of the company or his subordinates in au-

thority. The term "Inspector" refers to the Inspector or Inspectors representing the Company. The term "Company" refers to the railway company or railroad company party to the agreement. The term "Contractor" refers to the erection contractor party to the agreement.

Work to Be Done.—2. The Contractor shall erect the metal work, make all connections and adjustments, remove the old structures and falsework and do all work required to complete the bridge or bridges, as covered by the agreement, in accordance with the plans and these specifications.

Drawings to Govern.—3. Where the drawings and the specifications differ, the drawings shall govern.

Plant.—4. The Contractor shall provide all tools, machinery and appliances, including drift pins and fitting up bolts, necessary for the expeditious handling of the work. The Contractor shall protect the Company against claims on account of patented devices or parts used by him on the work.

Plans.—5. The Company will furnish complete detail plans for the structure or structures to be erected, including shop details, camber diagram, erection diagrams, match-marking diagrams, list of field rivets and bolts, and copy of shipping statements showing a full list of parts and weights.

Materials.—6. The Contractor shall receive, f. o. b. cars, at the siding to be designated in the information to be given bidders, all materials entering into the finished structure.

Handling and Storing Materials.—7. The Contractor shall unload material promptly upon delivery, otherwise he shall be responsible for demurrage charges. Stored material shall be piled securely outside the tracks, and no material shall be placed closer than six feet to the nearest rail. Material shall be placed on skids, above the ground, be kept clean and properly drained. Girders and beams shall be placed upright and shored. Long members, such as columns and chords, shall be placed on skids near enough together to prevent injury by deflection. The Contractor shall check all material turned over to him against shipping lists and report promptly in writing any shortage or injury discovered. He will be held responsible for the loss of any material while in his care, or for any damage resulting from his work.

Falsework.—8. Unless otherwise provided, the Contractor shall prepare and submit to the Engineer for approval, plans for falsework or for changes in the existing structure necessary for maintaining traffic. The falsework shall be properly designed and substantially constructed and maintained for the loads which will come upon it. Approval of the Contractor's plans shall not be considered as relieving the Contractor of any responsibility. Temporary structures or falsework placed by the Company, if suitable, may be used by the Contractor.

Masonry.—9. The Company will construct the masonry to correct lines and elevations, and will establish the lines and elevations required by the Contractor for setting the steel.

Bearings and Anchorage.—10. Bed plates, bolsters and shoes shall be set level in exact position. They shall be given full and even bearing by setting them on a layer of Portland cement mortar or dry cement, or by tightly ramming in rust cement after blocking them accurately in position, as directed by the Engineer.

11. The Contractor shall drill the holes and set the anchor bolts, except where the bolts are built into the masonry. The bolts shall be set accurately and fixed with Portland cement grout completely filling the holes.

Methods and Equipment.—12. Before starting work, the Contractor shall advise the Engineer fully as to the method he proposes to follow, and the amount and character of equipment he proposes to use, which shall be subject to the approval of the Engineer. The approval of the Engineer shall not be considered as relieving the Contractor of the responsibility for the safety of his method or equipment or from carrying out the work in full accordance with the plans and specifications. No work shall be done without the sanction of the Engineer.

Assembling Steel.—13. All parts shall be accurately assembled as shown on the plans and any match-marks carefully followed. The material shall be carefully handled so that no parts will be broken or damaged. Hammering which will injure or distort the work will not be permitted. Bearing surfaces and surfaces to be in permanent contact shall be cleaned just before the members are assembled. Unless erected by the cantilever method, truss spans shall be erected on blocking so placed as to give the trusses proper camber until all tension chord splices are fully riveted and all other truss connections pinned and bolted. Rivets in splices of butt joints in compression members shall not be driven until the span has been swung. Splices and field connections shall have one-half of the holes filled with bolts and cylindrical erection pins (half bolts and half pins) before riveting. Splices and connections carrying traffic during erection shall have three-fourths of the holes so filled.

Fitting up bolts shall be of the same nominal diameter as the rivets, and the cylindrical erection pins shall be $\frac{1}{32}$ inch larger.

Riveting.—14. Riveting preferably shall be done with pneumatic riveters and buckers. Rivets larger than $\frac{7}{8}$ inch in diameter shall not be driven by hand. Connections shall be accurately and securely fitted up before the rivets are driven. Light drifting will be permitted to draw the parts together, but drifting to match unfair holes will not be permitted. Unfair holes shall be reamed or drilled. Rivets shall be heated to a light cherry color, and in driving shall be upset to completely fill the holes. Heads shall be full and symmetrical, concentric with the shank, and shall have full bearing all around. They shall be the same shape and size as the heads of the shop rivets. Rivets shall be tight and shall grip the connected parts securely together. No recupping or caulking will be permitted. Rivets shall not be overheated or burned. In removing rivets, the surrounding metal shall not be injured; if necessary, such rivets shall be drilled out. Cup faced dollies, fitting the head closely to insure good bearing, shall be used.

Bolted Connections.—15. In bolted connections, bolts shall be drawn up tight and threads burred so that nuts cannot become loose.

Pin Connections.—16. Pilot and driving nuts shall be used in driving pins. They will be furnished by the Company and shall be returned to the Company on completion of the work. Pin nuts shall be screwed up tight and threads burred so that the nuts cannot become loose.

Deck.—17. Where so specified, the ties, guard timbers, guard rails, fire decking, concrete decking, waterproofing, ballast, and deck planking, and the track rails and tie plates, shall be placed by the Contractor. The timber deck, if untreated, shall be framed and placed in accordance with the Company's plans. The ties shall be framed to give a full and even bearing on the girders and under the rails. The guard timbers shall be dapped and framed to a snug fit over the ties and fastened as shown on the plans. If treated timber is used, the Company will deliver it properly framed to the Contractor. If necessary to do any framing or cutting of treated timber, the resulting surfaces shall be given a brush treatment with wood preservative, as directed by the Engineer. Where concrete decking is used, or waterproofing is required, the specifications therefor will be furnished by the Company.

Misfits.—18. Corrections of minor misfits and a reasonable amount of reaming will be considered as a legitimate part of the erection. Any error in shop work which prevents the proper assembling and fitting up of parts by the moderate use of drift pins, and a moderate amount of reaming and slight chipping or cutting shall immediately be reported to the Inspector, and his approval of the method of correction obtained. The correction shall be made in the presence of the Inspector, who will check the time expended. The Contractor shall render within thirty days an itemized bill for such work of correction for the approval of the Engineer.

Painting.—19. Heads of rivets shall be painted by the Contractor. This painting shall not be done until the Inspector has examined the rivets and found them satisfactory. The tops of stringers and girders which are to carry ties shall be given one coat of field paint.

If the field painting is to be done by the Contractor, the specifications therefor will be furnished by the Company.

Removal of Old Structure and Falsework.—20. The Contractor shall dismantle the old structure and falsework and load the material on cars for shipment, or pile it neatly at a site immediately adjacent to the tracks, at a convenient elevation for future handling, as directed by the Engineer. When the old structure is of iron or steel and is to be used again, it shall be dismantled without unnecessary damage and the parts match-marked.

21. The Contractor shall remove the piling to the surface of the ground and all debris and refuse resulting from his work, leaving the site in good condition.

Superintendence and Workmen.—22. During the entire progress of the work the Contractor shall have a competent foreman or superintendent in personal charge of the work. Instructions given to the foreman or superintendent shall be considered as given to the Contractor. All work shall be done by skilled, competent workmen.

Interference With Traffic.—23. The Contractor shall conduct his work in such a manner that the track, while in service, will be safe and clear for the passage of trains. Tracks shall be disturbed or removed for the prosecution of the work during such times only as allowed by the Company. While the Contractor is actively engaged in the erection, trains will be required to approach the bridge prepared to come to a stop before crossing and will proceed only on signal. During the time the Contractor operates his equipment on the tracks or has occasion to make the tracks unsafe for the operation of trains, his operations will be in charge of a conductor or pilot who will arrange and control the train movements.

Company Equipment.—24. When the agreement provides that the Company shall furnish equipment to the Contractor,

such as flat cars, water cars, bunk cars, etc., the Contractor shall repair all damage to such equipment furnished for his use and return it in as good condition as when he received it.

Work Train Service.—25. When under the contract work train or engine service is furnished the Contractor without charge, the Contractor shall state in his bid the number of days such service will be required. Any excess over the time specified in this bid shall be paid for by the Contractor at the Company's schedule of rates.

Risk.—26. The Contractor shall be responsible for loss of or damage to materials and for all damage to persons or property and for casualties of every description caused by his operations during the progress of the work. Injuries or losses due to events beyond the control of the Contractor shall not be borne by him unless they occurred because of his dilatory methods in handling the work, extending the time beyond the time limit designated in the contract.

Inspection.—27. The work shall be subject at all times to inspection by the Engineer.

Laws and Permits.—28. The Contractor shall comply with federal, state and local laws, regulations and ordinances, and shall obtain at his own expense the necessary permits for his operations.

Appendix B—Specifications for Movable Railway Bridges

The purpose of the committee which wrote these specifications was to formulate specific and detailed rules for the design and manufacture of movable railway bridges, as a guide to both the designer and the shop, rather than to confine the specifications to a statement of principles or to limit them to rules defining the duties of the contractor. The intention was to describe the best general practice in the accepted types now in use for standard American and Canadian railways and to advance the causes of good design and workmanship. The requirements of light and branch railways and foreign practice have not been considered.

The specifications in preliminary form were printed in Bulletin No. 204 and in the Proceedings, Vol. 19, and discussions and suggestions were invited. The discussions received were printed in Bulletin No. 228 in 1920. These, together with later written and verbal discussions, were considered by the committee in the final revision.

(These specifications covered 54 pages of Bulletin No. 240, too long to be reproduced here.)

Discussion

Chairman Selby submitted the recommendations for adoption and printing in the Manual as given at the head of the report *and moved their approval by the convention. Motions to this effect were passed.* He also introduced an additional change to article 157 of the specifications not covered in the committee's report as published in the bulletin. This provides that there is to be added under table of physical properties the following:

Elongation in 2 in. minimum per cent 22.

This change was also approved.

Mr. Selby then introduced specifications for the erection of steel railway bridges, explaining that these were submitted as information and that any comments or criticisms of these specifications would be considered by the committee in reviewing these specifications for resubmission in final form next year. A number of speakers submitted suggestions which the committee will take under advisement. *A motion by Mr. Selby that the specifications be received as information for publication in the proceedings was carried.*

The specifications which the committee submitted for movable railway bridges as referred to in Appendix B of the report was then submitted by Mr. Selby and after pointing out a number of typographical errors, *he moved the adoption of these specifications for printing in the Manual. This motion was carried* and the committee was dismissed with the thanks of the association.

Report on Signals and Interlocking

A committee of the American Railway Association is now studying the subject of automatic train control. The substitution of incandescent lamps in headlights results in the elimination of many difficulties in signal visibility due to the glare of arc lights. The committee recommends the installation of an arrangement of shields to prevent the light on approaching trains from showing through colored glass on dwarf signals and giving a wrong indication. Wrong indications due to the reflection of light can be eliminated by the use of convex roundels or the adjustment of the signal; the committee recommends the adoption of the former for new work and renewals.

W. J. Eck
Chairman

W. J. Eck is finishing his second year as chairman, after having served for four years as vice-chairman. He has been a member of the committee since 1911. Mr. Eck has been signal and electrical superintendent of the Southern Railway System since 1907. He has taken an active interest in the development of signal and electrical standards and has done much to promote their use, being one of the pioneers in the introduction of alternating current signals in this country. He has also been active in the work of the Railway Signal Association, now the Signal Section of the Engineering Division of the American Railway Association.

REPORTS ON COLORS for signals, light signals, requisites for signal locations and the aspect indicating that a train must take siding at a non-interlocked switch will be found in the proceedings of the American Railway Association, Signal Section. The subject of automatic train control is now being handled by the Joint Committee on Automatic Train Control.

The Effect of Electric Locomotive Headlights on Signals

But little difficulty has actually been experienced due to the effect of locomotive headlights and this has been largely eliminated with the abandonment of the arc light and the use of incandescent lamps in the headlights, with the consequent reduction in candlepower as well as the difference in characteristics of the two lights. The difficulties remaining are three:

(1) The inability of an engineman on one train to read the signals on account of the headlight on a train in the opposing direction blinding him.

(2) The headlight on a train in the opposite direction showing through the colored glass on a dwarf signal other than the one in front of the lamp and so giving a wrong indication.

(3) The light from a locomotive headlight on a train being reflected back from a signal and so giving a wrong indication.

The first of these difficulties has been obviated where they occur by having the enginemen dim the headlights

when approaching trains running in the opposite direction.

The second difficulty has been obviated by arranging a shield on dwarf signals behind the colored glass of spectacles which are not in front of the lamp.

The third difficulty has been obviated by either: (a) Adjustment of signal. (b) Use of convex roundels.

The use of such roundels will obviate the trouble should signal not be in proper adjustment.

The committee recommended:

(1) That shields be installed on dwarf signals behind the colored roundels not in front of the lamp.

(2) That convex roundels be used on all new work and renewals.

Committee: W. J. Eck (Sou.), chairman; W. M. Vandersluis (I. C.), vice-chairman; Azel Ames (Cons. Engr.), H. S. Balliet (N. Y. C.), A. M. Burt (N. P.), C. E. Denney (N. Y. C. & St. L.), F. L. Dodgson (Gen. Ry. Sig.), W. H. Elliott (N. Y. C.), G. E. Ellis (Aut. Train Con. Com.), J. G. M. Leisenring (I. T. S.), H. K. Lowry (C. R. I. & P.), J. C. Mock (M. C.), F. P. Patenall (B. & O.), J. A. Peabody (C. & N. W.), A. H. Rudd (Penna.), A. G. Shaver (Cons. Engr.), T. S. Stevens (A. T. & S. F.), E. E. Worthing (S. P.).

Discussion

W. J. Eck (Chairman): The material which the committee is reporting is for the purpose of information only.

C. E. Lindsay (N. Y. C.): What are the recommendations on the subject of railway lamps?

Chairman Eck: At the meeting of the Committee on Standardization, where the subject of railway lamps was discussed, the chairman of the Committee on Signals and Interlocking presented the series of lamps which had heretofore been adopted by the Signal Association. Since that meeting, however, the Signal Section has presented a revised drawing of one of the lamps and it was voted on yesterday. On account of the proposed revision of one of the lamps in the series, the chairman of the committee did not think the series was in shape to present to you today.

G. A. Mountain (Can. Ry. Co.): Has the committee considered the question of eliminating guard rails at interlocking crossings?

Chairman Eck: I have been a member of the committee for many years, and do not not recall the subject being discussed by the committee.

(The motion to accept the report as information was moved and carried.)

Report of Committee on Standardization

The committee reports progress in its efforts to secure the adoption of standards already approved by the association as well as in harmonizing differences of opinion regarding other specifications. Sponsorship for the unification of specifications for cross-ties and switch-ties offered by the American Engineering Standards Committee to the Association was accepted and the specifications approved by the Association will be offered as a basis for unified specifications. The belief is expressed that the present specifications for creosote oil tend to exclude what seems to be genuine coal tar creosote oils and that some change should be made to cover that point.

E. A. Frink
Chairman

E. A. Frink has been chairman of this special committee since its organization three years ago, the remainder of the committee consisting of the chairmen of the standing committees with two additional representatives from Canada. Mr. Frink has been principal assistant engineer of the Seaboard Air Line since April, 1914, prior to which time he was bridge engineer for eight years. He has long been an advocate of the more extensive use by the railways of the standards adopted by the association, and after the committee was organized to promote this end he was the logical selection for chairman. He also is a member of the A.E.S. Committee.

THE ASSOCIATION has approved as recommended practice, specifications and designs of the Ballast committee covering tamping bars, tamping picks and ballast forks of the Proceedings for 1921. These specifications and designs are being handled by this committee with the purpose of securing their adoption by the roads and producers.

Ties.—The association was represented by the Tie committee in a conference called by the American Engineering Standards Committee on the unification of Specifications for Cross-Ties and Switch Ties and the association was nominated as a sponsor for the project. The sponsorship has been accepted and Committee III expects to present the specifications approved by our association as a basis for unified specifications.

Rail.—During the year, the Rail committee endeavored to harmonize differences with the rail manufacturers on the standard specification for open-hearth steel rail, but so far without success. However, it is expected that some progress may be made, which will be reported to the convention.

Track.—The committee is glad to report that the manufacture of frogs and switches, previously adopted by the association, is increasing rapidly and that the use of the association's accepted designs for cut and screw spikes is being promoted as much as possible.

Masonry.—The Committee on Masonry recommends that the Specifications and Tests for Portland Cement, adopted as recommended practice by the American Railway Engineering Association at the convention in 1917, be accepted for standardization, except that paragraph 36 be omitted, as noted in the report of that committee.

Signals and Interlocking.—The committee recommends that the following drawings showing oil burning railway lamps and detail parts, RSA 1100-1101, and ARA Signal Section Drawings 1430, 1440-1441-1442-1443-1445-1459-1460-1461-1470-1480-1496-1497-1498-1499, be submitted to the American Engineering Standards Committee for standardization.

Water Service.—The committee recommends the standardizing of the American Water Works Association's standards for cast iron pipe, hydrants, and valves.

Wood Preservation.—It would appear the present American Railway Engineering Association specifications for creosote oils tend to exclude what seem to be genuine coal tar creosote oils, and it is expected that there will

have to be a change in our creosote oil specification before the next annual meeting.

Electricity.—If approved by the convention, the specifications for friction and rubber tape will be presented to the American Engineering Standards Committee for standardization.

Conclusions

The committee recommended that the following subjects be submitted to the American Engineering Standards Committee by a representative of the American Railway Association before that committee as a basis for standardization:

1. American Water Works Association standards for cast iron pipe, hydrants and valves.
2. Tamping bars, tamping picks and ballast forks.
3. Specifications as prepared by the Tie Committee of the A. R. E. A.
4. Railway Lamps.
5. Commercial Adhesive Tape and Rubber Insulating Tape.

Committee: E. A. Frink (S. A. L.), chairman; J. R. W. Ambrose (Toronto Term.), vice-chairman; W. C. Barrett (L. V.), F. L. C. Bond (I. C.), W. A. Clark (D. & I. R.), A. F. Dorley (M. P.), W. T. Dorrance (N. Y. N. H. & H.), W. J. Eck (Sou.), J. M. R. Fairbairn (C. P. R.), W. D. Faucette (S. A. L.), A. S. Going (G. T.), W. H. Hoyt (D. M. & N.), Maro Johnson (I. C.), C. E. Johnston (K. C. S.), Edwin B. Katte (N. Y. C.), A. Montzheimer (E. J. & E.), F. E. Morrow (C. & W. I.), G. J. Ray (D. L. & W.), L. S. Rose (C. C. C. & St. L.), O. E. Selby (C. C. C. & St. L.), F. J. Stimson (Penna.), H. M. Stout (N. P.), C. M. Taylor (C. of N. J.), W. P. Wiltsee (N. & W.), J. J. Yates (C. of N. J.).

Discussion

(The report of the committee was presented by Chairman Frink who read a report outlining the purposes and functions of the American Engineering Standards Committee and reporting the progress in standardization in this country and abroad.)

Mr. Frink: I think that more assistance will be obtained from the American Engineering Standards Committee in the matter of standardization than in any other way that we might select. I therefore urge all, if possible, to vote favorably on the committee's recommendation to refer these five matters to the American Engineering Standards Committee for their action.

I move the approval of the Recommendations 1 to 5.

H. R. Safford (C. B. & Q.): I am thoroughly in accord with the recommendation and the comment I make is merely upon a technicality, as to whether we should take the action contemplated, especially with reference to item No. 4, which says: "Railway lamps as developed by the Committee on Signals and Interlocking, to be presented by that committee at the next convention." The point I want to raise is, can we at this time take action that places this matter before the American Engineering Standards Committee until it has been acted upon by the body from which it originated?

Chairman Frink: Our sending anything to the American Engineering Standards Committee does not signify that the Association has approved it at all. It simply means that the Association thinks that that particular thing should be standardized, and that we are willing to be sponsor for such standardization, but that we will not accept it unless it suits our convention after it is done.

J. J. Yates (C. of N. J.): I am a member of the Standards committee. The Standards committee in accepting a suggestion for standardization considers that the Association has come to an agreement on the specification and are ready to back it up. I think you are a little premature in subscribing a specification now that has not had the approval of this association.

C. A. Morse (C. R. I. & P.): I cannot help but agree with the last speaker. It seems to me that we ought to be able to back these five things that we are to present to the Standardization committee.

Chairman Frink: It is almost inconceivable that anything that we may get up, no matter how carefully it is done, will suit all the different interests who are on the sectional committees of the American Engineering Standards Committee. If a subject has been approved by this convention, the Standards committee will be placed in the unenviable position of being asked to agree to a modification of something which the convention has approved.

W. M. Camp (Railway Review): If something which has been approved by this convention and is in our Manual is presented to the American Engineering Standards Committee will it come back to the A. R. E. A. to be modified?

Chairman Frink: It will come back to us, but not to be modified except as regards ourselves. We are our own court of last resort in regard to our own practice. We will adopt it or not, as we see fit.

Mr. Morse: In looking over these resolutions, I understand No. 4 is part of the work of the Committee on Signals and Interlocking, and that it is to be presented to this convention. No. 5 is part of the Committte on Electricity, and it is to be presented to this convention. It seems to me we could pass these resolutions as Mr. Frink wants with the proviso that if the convention approved them when they are reported from the various committees they are presented by, they are all right; if not, they are not.

Chairman Frink: The committee will accept that suggestion, I am sure.

(*The motion was carried.*)

Chairman Frink: Referring to the method of handling projects with the Engineering Standards Committee, *I want to offer this motion:*

Resolved, That whenever a project prepared for or approved by the proper standing committee is reported to the Board of Direction of the Association by our Committee of Standardization, with a recommendation for presentation to the American Engineering Standards Committee, said Board of Direction be and is hereby authorized to, in its discretion, present such project to said American Engineering Standards Committee with a request for action, this association to be a sponsor for such project.

That covers the point made by Mr. Safford a little while ago, but instead of making your standardization committee the direct intermediary with the Engineering Standards Committee, it makes the Board of Direction the intermediary.

H. Churchill (N. & W.): This motion is all right with one proviso, i. e., that this committee stand between this association and the A. R. A.

Chairman Frink: Inasmuch as the Board of Direction would take the action, and inasmuch as our secretary is also secretary of the Engineering division of the A. R. A., it was sufficiently safeguarded.

F. J. Stimson (Penna.): It should be made plain to the A. R. A., and *I move that the resolution be amended in such a way as to provide that one year after the adoption of the A. R. E. A. recommended practice, that the Board of Direction,* . . . We do not want to go on record at this time as authorizing the Standardization committee to make recommendations to the Board of Direction, and have the Board of Direction take action with the American Engineering Standards Committee before the matter has come before the convention.

(*Motion as amended carried.*)

(The committee was dismissed with the thanks of the association.)

Report of the Committee on Ties

Satisfactory reports on cross ties and preservative treatments are difficult to secure because of lack of proper data, and much trouble has arisen because of the effort to secure absolute rather than relative values for tie life. To remedy this a standard tie should be adopted and comparative tests made with other ties, according to a prescribed method. Tie plates should have a shoulder to maintain gage and to transmit the thrust properly to the tie through the plate. No movement should be allowed between the tie plate and the tie while a freeway of $\frac{1}{16}$ in. to $\frac{3}{16}$ in. should be maintained between the spike head and the rail base.

W. A. Clark
Chairman

W. A. Clark is completing his first year as chairman of this committee, prior to which he served as vice-chairman for two years. He has been a member of the committee for nine years. Like his predecessor, F. R. Layng, he is connected with one of the railway properties of the United States Steel Corporation, being chief engineer of the Duluth & Iron Range. He has long been an active student of the tie question and has had much to do with the work of the committee in its investigation of the relative economies of ties of various materials as well as of its inspections and reports on the various installations of substitute ties for steam railroads.

In Appendix A the committee submitted the results of its study on the economics of the use of the various classes of cross-ties and various kinds of preservative treatment and also the classification of ties for various kinds of service.

The committee also presented its usual report on substitute ties. A report on the effect of the design of tie plates and track spikes on the durability of cross-ties and the results of improperly protecting ties from mechanical wear was given in Appendix C.

Conclusions

The committee recommended the following action on its report:

1. That the report covered in Appendix A be received as information and the recommendations pertaining to standard test ties be approved.
2. That the report on substitute ties be received as information.
3. That the report on Care of Ties after Distribution be continued.
4. That the report covered in Appendix C be received as information and the subject discontinued.

Committee: W. A. Clark (D. & I. R.), chairman; W. J. Burton (M. P.), vice-chairman; W. C. Baisinger (A. T. & S. F.), M. S. Blaiklock (G. T.), F. Boardman (N. Y. C.), S. B. Clement (T. & N. O.), E. L. Crugar (I. C.), John Foley (Penna.), O. H. Frick (C. M. & St. P.), G. F. Hand (N. Y. N. H. & H.), F. R. Layng (B. & L. E.), R. M. Leeds (L. & N.), A. F. Maischaider (C. C. C. & St. L.), A. J. Neafie (D. L. & W.), G. P. Palmer (B. & O. C. T.), L. J. Riegler (Penna.), E. W. Boots (P. & L. E.), H. A. Cassil (P. M.), F. W. Cherrington (Jennison-Wright Co.), J. F. Deimling (M. C.), H. C. Hayes (I. C.), Lowry Smith (N. P.), H. A. Anderson (S. P.).

Appendix A—Economics of the Use of Various Classes of Cross-Ties and Various Kinds of Preservative Treatment and Also the Classification of Ties for Various Kinds of Service

Satisfactory report on these subjects would require tie life data which is non-existent, and not only is this true, but the committee, after a careful consideration of the requirements, is of the opinion that the data from tests now under way will hardly be satisfactory for use in solving these problems. As the need for proper data will increase rather than decrease, with the diminishing timber supply, the committee desires to point out wherein tie-life data is unsatisfactory and wherein tests may be made to produce more usable results. The committee realizes the difficulty of comparing installations under different conditions and is of the opinion that much of the trouble is due to an effort to obtain absolute rather than relative values for tie life.

If, in every test installation, there could be included a standard tie, to serve as a unit of comparison, the result, as measured by the standard tie, could be applied anywhere, where knowledge of the performance of the standard tie is available. The committee, therefore, recommended that in order to provide suitable data in the future the following practice with regard to test installations be followed:

(a) Install at the same point, in the same track, under the same traffic and under the same conditions of rail, ballast, drainage, sunlight, etc., an equal number, up to not less than 100, "Standard Test" ties.

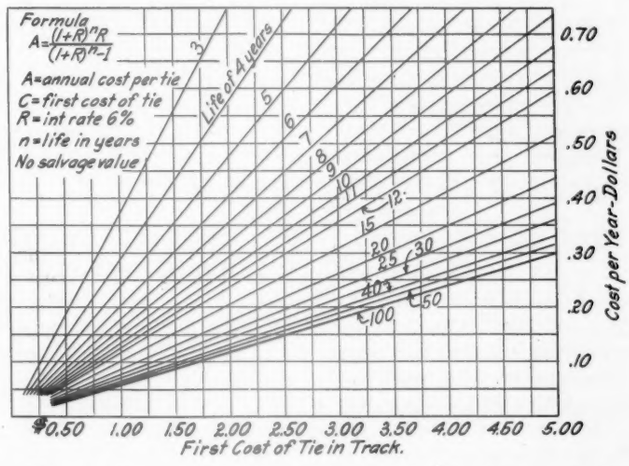


Fig. 1. Annual Renewal Costs, 6 Per Cent Compound Interest

(b) Continue the test record until all standard test ties have been removed as well as all other ties of the test.

(c) Standard test tie to be A. R. E. A. 1921 specification, grade 3 (6 in. by 8 in.), class U, white oak, 8 ft. long, untreated.

(d) Record should include information called for on Form No. 1, Report of Experimental Test Tie Sections, as recommended by the Tie Committee, see page 339 of volume 22, A. R. E. A. Proceedings.

In using this form the following data should be given:

1. Gross tons per year passing over the test, freight plus passenger.

2. Average annual rainfall.
3. Mean temperature of locality for January, and July, and highest and lowest extremes.
4. Ballast—kind and depth.

The tie selected as standard test can be secured, at least in the small numbers needed for test installations, without an undue amount of transportation to most of the country. The Grade 3 is selected instead of Grade 5 because it has shorter life.

Mechanical Strength

A tie performs three principal functions: (a) Acts as a beam to distribute the load, (b) Acts as a block to transmit the load from rail to ballast, and (c) Holds the rails in place.

It is, therefore, required to possess beam strength, crushing strength and ability to hold fastenings. As between the three, the beam strength is fundamental, because, if deficient in any given tie, there is no remedy, whereas a deficiency in crushing strength or ability to stand compression across the grain can be remedied by suitable tie plates and the ability to hold fastenings modified by the design of the fastenings.

Effect of Size and Tie Plates

The replies to the committee's questionnaire indicated a general belief that ties 7 inches by 9 inches would outlast ones 6 inches by 8 inches when subjected to the

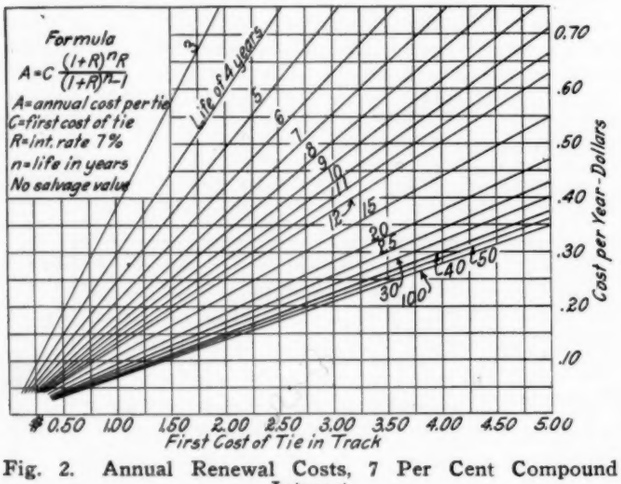


Fig. 2. Annual Renewal Costs, 7 Per Cent Compound Interest

same conditions. The replies would, perhaps, average 25 per cent. The data given in the questionnaire relative to ties failing by decay shows an average of 30 per cent greater life for the 7 inch ties, plated, over the 6 inch ties and 20 per cent for the 7 inch ties, unplated, over the 6 inch ties. These check the opinions fairly well. It is also found that the value of the tie plate in the case of 6 inch ties is 12 per cent, and in the case of the 7 inch ties 21 per cent. All of these percentages must be considered only approximate, due to the character of the data.

Figures 1 and 2 have been prepared from the formula recommended by this committee for ascertaining annual cost. They are self-explanatory.

Conclusions

Tie life data does not exist from which satisfactory conclusions may be reached on the subjects assigned. Information lacking is partly as follows:

(a) Actual life data with the conditions of use recorded completely enough to permit satisfactory comparisons between results on different railroads.

(b) Information as to how the "average" life reported is obtained.

(c) Information as to whether the relative resistance to decay of various woods is independent of climate.

(d) Information as to whether the best decay resisting tie untreated is also the best decay resisting tie when treated, whether treatment results in the addition of a uniform number of years' life to all kinds of timber, or more to some kinds than others, or whether it results in giving all kinds of ties the same average life under the same conditions.

(e) How mechanical strength is related to resistance to mechanical wear.

(f) How mechanical strength varies with time in track, i. e., from the condition new to the condition when decay necessitates removal.

Recommendations

(1) The inclusion of the standard test tie in all test installations, for the purpose of comparison, as more particularly outlined above.

(2) The adoption of white oak ties, grade 3 (6 in. by 8 in.), class U, untreated, 8 ft. long, as standard for test purposes.

(3) Laboratory test of the mechanical properties of tie timber, which has been subjected to contact with the soil for varying periods under conditions similar to those to which ties are subjected in track. Such tests should develop the relationship between strength and time exposed to the tie destroying agencies other than traffic.

Appendix C—Effect of the Design of Tie Plates and Track Spikes on the Durability of Cross-Ties

The following features should be provided for to ensure a minimum of damage to the tie:

a. Adequate strength and area to prevent buckling and excessive settlement in the tie. The required bearing area and thickness will be governed by the kind of wood and character and amount of traffic. The distances the plate extends beyond either side of the rail base should be so proportioned as to prevent uneven settlement of the plate into the tie and consequent rolling of the rail. Allowance should be made for the deterioration of the tie plate which will normally take place, particularly near salt water or where there are brine drippings.

b. It is important that the tie plate have a shoulder to maintain gage, so that the thrust from the rail is transmitted to the tie through the bearing area of the tie plate and the spikes as a unit, instead of being directly resisted by any spike.

c. There should be no movement between the tie plate and the tie. The effect of any looseness is to make a "track which rattles," causing damage to the plate bearing area of the tie and enlargement of the spike holes. This close connection between tie plate and tie can best be accomplished by the use of separate fastenings which do not touch the rail and whose only function is holding down the plate. The ordinary means is to provide projections on the bottom of the tie plate; these should be deep enough to provide the required bond and to do their part in strengthening the tie plate, but so shaped and of a depth to do as little damage as possible to the tie, and it is believed that the depth of such projections should not exceed $\frac{3}{16}$ in., and be so shaped as not to cut the fiber of the wood. When screw spikes are used, a rest shoulder should be provided on which the screw spike bears when driven home, leaving a freeway between the rail base and the under side of the spike head; this aids in making the bond between tie plate and tie. The freeway between the underside of the spike head and the rail base is of great importance and should be from $\frac{1}{16}$ to $\frac{3}{16}$ inch., depending on character of the subgrade.

Spike—Effect of Design

Safe and good track can be obtained by use of either screw spikes or different forms of cut spikes, and the choice between these is purely a question of which is more economical, all things considered; there is no evidence at this time that the screw spike in itself prolongs the life of the tie. The thread on the spike must be accurate in dimension and pitch (made to fit gages as recommended by the association standard), and so made in conjunction with a leader that the spike can be easily started in the hole in the tie by a light tap from a hammer. These features are provided for in the associa-

tion standard, and failure to observe them results in destruction of the screw threads in the wood either in the initial application of the spike or in replacing spikes when renewing rail. The necessary freeway between the screw spike head and the base of the rail should be secured through the design of the tie plate.

Method of Application

The surface of the tie should have an accurate bearing surface to receive the tie plate; this is best accomplished by machine adzing. There is considerable advantage in prolonging the life of the tie by boring holes to receive the spikes; this is, of course, necessary to the application of screw spikes. If cut spikes are used the expense of boring untreated ties is not warranted, but all treated ties should be bored for spikes if the maximum life of the timber is to be secured. Such holes should preferably be bored entirely through the tie to ensure adequate depth when the tie plate has settled into the tie.

When treated ties are used all adzing and boring should be done before treatment. In case it becomes necessary to bore any holes in treated ties in the field, as in the case of switch ties, or to use tie plugs, the holes should receive an application of preservative before the spike or plug is applied. All tie plugs used in treated ties should be treated.

Attention is called to the danger of over-spiking. When the number of spikes is sufficient to hold the rail and gage properly, any additional spiking unnecessarily injures the tie at the most critical point. Additional spikes may be driven when actually required.

Discussion

V. K. Hendricks: The committee could get more reliable information by a study of the actual renewals on the different railroads, by going into more detail than has heretofore been done.

W. H. Courtenay (L. & N.): The committee seems to indicate that a white oak tie will last 6 yr. and a cypress tie will last 5.4 yr. This is certainly not true of certain parts of our country. In our part of the country a white oak tie, produced in that territory, will not last more than six years, and I have actually seen cypress ties that have been in use for over 30 years. It is a matter of extreme difficulty to get correct information about ties.

W. J. Burton (Vice Chairman): Last year we tried to get information about cypress ties, but the L. & N. did not reply to it. We realize that this whole subject is one which with our present knowledge cannot be determined with mathematical accuracy.

F. J. Stimson (Penna.): The committee adopted the 6-in. tie, because it had a shorter life than the 7-in. I was looking at table one, which I understand shows the same life for the 6-in. white oak as for the 7-in. white oak.

Vice Chairman Burton: That is accounted for by the fact that the larger ties in general are used on roads of heavier traffic, and they are worn out.

W. R. Armstrong (O. S. L.): What application will this have to western roads that do not have any oak ties and do not use 6-inch ties?

The President: The idea is that the standard tie be used for testing, and not adopted as a standard tie for the roads.

J. L. Campbell (E. P. & S.): The ratio of the durability of the redwood ties, which go to make up the statement of these tables, as compared with the white oak appears to be surprisingly low on the basis of the quality of the redwood that used to be secured, but is not too low on the basis of some of the redwood ties that are secured in these days.

F. J. Angier (B. & O.): If you are basing the different ties on 6-in. by 8-in. white oak ties, giving a certain length of life, what kind of oak tie do you refer to—northern, southern, chestnut oak, i. e., what species of oak is it?

Vice Chairman Burton: That question is answered by the specification for white oak ties in last year's report. The proportion of sap and heart average is specified.

J. R. Leighty (Pres. Conference Committee): It is entirely possible that the plan the committee has outlined will establish what seems to me a very valuable factor for guiding the service-life of timber from the same species obtained in different parts of the country.

(The committee was dismissed with the thanks of the Association.)

Report of Special Committee on Stresses in Track

The principal work of 1921 has been the reduction and correlation of the data of the field tests made in 1920. It will be recalled that tests were conducted on the tracks of the Illinois Central in Illinois, the Delaware, Lackawanna & Western in New Jersey, and the Atchison, Topeka & Santa Fe in New Mexico and Iowa. These tests were made on tangent and curved track, several different curvatures being used. A principal purpose of the tests was to find the effect of curvature of track upon the stresses in the rail (including lateral bending stresses) caused by locomotives of different types run at different speeds, as compared with the stresses developed in straight track. The time required for the reduction of the large amount of data accumulated in the tests has been much greater than was anticipated. The work has been carried on steadily, however, and good progress has been made. It is hoped that the committee will be able to present another report during this year. The results found indicate that information of value on stresses developed in curved track may be expected. Laboratory and field tests have also been conducted on rail joints and interesting results have been developed.

A. N. Talbot (Univ. of Ill.), *Chairman.*

Discussion

Prof. A. N. Talbot (Chairman): This is only a progress report. The committee has some further work in charge, the results of which we hope to present in our next report.

C. H. Mottier (I. C.): Has the committee given any attention to the distribution of earth pressure or is that a field for further work.

Chairman Talbot: The work on that has not gone very far. Tests in the laboratory were conducted which are applicable to the transmission of pressures through any granular material, and during the year some further effort has been made to find out whether there would be results of value following these tests in the laboratory on the way in which the pressures are transmitted in any granular material. So far as an attempt to do this in an embankment is concerned, I am afraid it would not result in anything of value unless it was done on such a greatly increased scale and under so many different conditions that the cost of the work would be entirely prohibitive.

(The committee was dismissed with the thanks of the Association.)

Report on Economics of Railway Labor

Considerable study was given to such data as could be acquired in order that conclusions might be drawn that would be of value in solving individual as well as general labor problems. The plans, submitted for insertion in the Manual, cover methods for obtaining railway labor and methods for training and educating employees in engineering and maintenance work, with definite conclusions. In studying the performance of maintenance of way work it was found that there was a remarkable uniformity in the output of gangs working under apparently widely varying conditions. Fundamental principles of good management are based on accurate units of measure.

C. E. Johnston
Chairman

C. E. Johnston is finishing his second year as chairman and his fourth year as a member of the committee. Mr. Johnston has been general manager of the Kansas City Southern for four years, prior to which he was chief engineer. He has taken a keen interest in maintenance of way labor problems for many years and has maintained a close contact with his forces. With his knowledge of the problems confronting the operating as well as the engineering officer, he has brought to the committee a breadth of vision and a realization of the magnitude of the labor problem, which has contributed much in a practical way to the work of the committee.

THE WORK OF THE COMMITTEE during the past year has, to a large extent, embraced a study of the data assembled during 1920, and the co-ordination of certain well-defined principles and practices in order to formulate conclusions that may be helpful to the railways in solving their individual as well as general labor problems. The committee recommended that the conclusions in Appendices A, B and C be approved and published in the Manual.

Committee: C. E. Johnston (K. C. S.), chairman; C. H. Stein (C. of N. J.), vice-chairman; W. J. Backes (N. Y., N. H. & H.), A. F. Blaess (I. C.), B. M. Cheney (C. B. & Q.), C. C. Cook (B. & O.), L. E. Dale (Penna.), John Evans (M. C.), R. H. Ford (C. R. I. & P.), L. C. Hartley (C. & E. I.), J. L. Haugh (U. P.), T. T. Irving (G. T.), R. E. Keough (C. P. R.), E. R. Lewis (M. C.), R. M. Pearce (P. & L. E.), W. H. Penfield (C. M. & St. P.), John C. Sesser (W. & L. E.), J. R. Sexton (Erie), Earl Stimson (B. & O.), R. C. White (M. P.).

Appendix A—Plans and Methods for Obtaining Railway Labor

The conclusions reached are as follows:

1. The problem of obtaining railway labor is broad and one deserving of careful consideration and organization.
2. In the interest of efficiency and economy maintenance employees should have the necessary mental and physical qualifications.
3. Best results may be obtained by providing some officer or some organization to supervise the selection and care of employees.
4. The living conditions of employees should be sanitary and comfortable. Food should be wholesome and of sufficient quantity, and work so regulated as not to be injurious to health.
5. Every encouragement, consistent with economy and efficiency, should be given to permanent employment throughout the year.
6. To avoid abuses, free transportation for railway labor should at all times be within the control of regularly delegated officers or employees.

RECOMMENDATIONS

That the conclusions reached by the committee with reference to methods of obtaining labor be adopted and published in the Manual.

Appendix B—Methods for Training and Educating Employees in Engineering and Maintenance Work

The study was considered in the following light:

(A) Training and educating engineers or employees in the Engineering Department in maintenance work; and,

(B) Training and educating employees (other than engineers) in the Maintenance of Way Department, looking to greater economy and efficiency as well as promotion.

CONCLUSIONS ON SUBJECT A

1. Engineers trained in maintenance work are essential to an efficient organization.
2. The systematic training of young engineers for maintenance work should be carefully undertaken, and if in due course they do not display necessary qualifications to combine practical and technical training with ability to organize, direct and supervise work, they should not be retained in this branch of service.
3. Training of young engineers in maintenance work may best be accomplished by rotation in service.
4. It is essential to the training of young engineers that they familiarize themselves with the rules and practices of the operating and accounting departments.
5. In the interest of an efficient organization it is desirable to maintain a fixed minimum engineering force throughout the year.
6. It is desirable that there be practical co-operation between railway managements and schools and colleges offering technical courses for the better preparation of young engineers entering railway service.

CONCLUSIONS ON SUBJECT B

1. A thorough and systematic method of training employees in maintenance work is essential for efficiency and for promotion to advanced positions.
2. In promotion, merit and fitness should govern. Employees having necessary qualifications should be given every legitimate opportunity and encouragement to obtain necessary training and experience.
3. To accomplish best results, methods should be installed to promote individual effort and interest. Personal contact and personal interest shown on the part of the supervisory forces will go far to bring this about in all cases.
4. Employees should be encouraged to seek additional and more thorough education from outside sources on general principles of railway operation, such as through correspondence, night schools and periodicals on railway maintenance.

Appendix C—Standard Method for Performing Maintenance of Way Work for the Purpose of Establishing Units of Measure of Work Performed

(1) Standard Methods and Schedules

Standard schedules, or units of performance, should be established with great care, as it is essential that they be correct and that the organization of the gang and method of doing the work are the best that can be worked out.

The standard performance, or 100 per cent efficiency, is the output of a first-class gang working at a speed which can be continuously maintained without physical harm to the men, following an approved method of doing the work and consisting of the most effective number of men for the kind of work to be done.

To arrive at the 100 per cent standard, first-class gangs are to be selected and detail time studies made of the performance, the time studies being divided into as many moves and as much detail as possible in order that the various studies may be compared in detail and a standard method worked out which will eliminate all unnecessary moves. If it appears that an improvement can be made, the organization of the gang and the method of doing the work should be altered and new studies made. When the most satisfactory organization and method has been found, a final detail study is made of the performance of the gang, and this is established as 100 per cent efficiency and issued as a standard schedule. In this way schedules may be established for all of the more important items of maintenance work.

(2) Instructions to Foremen

To form an accurate comparison of the performance of the various gangs, uniformity in the reports submitted by the foremen is necessary. Owing to the difficulty some foremen have in making reports, it is desirable to have all forms used by them as simple as possible.

A daily report by the foreman of time spent and the work done by each gang is necessary. Where there is in use a form of daily time report, it can readily be made suitable for this purpose.

It is, however, necessary that the distribution shown on the daily time report be made with care, so that each item of work can be correctly graded. To secure this result detail instructions governing the distribution and reporting of the time charges are required.

(3) Planning and Dispatching

To outline the order of the work and to assign it to the gangs to follow in sequence, so as to reduce the loss of time consumed by the unnecessary movement of the gangs from place to place, a system of planning and dispatching is needed.

Early in the year the program of work for the season should be decided upon and charted on a planning sheet, the proposed work being shown in yellow. Thereafter as the work progresses, monthly planning sheets are prepared; the completed work is shown in green and the monthly program in red. A few days before the close of the month the division engineer calls a meeting of the supervisors for the purpose of planning the work for the month. The work to be done, the location and the relative order in which it is to be undertaken is decided upon and shown in red on the chart. The quantity of work to be accomplished is computed from the standard schedules and the force allotted for the month. The direction in which the work is to progress, the date on which it is to be commenced and the calculated date of completion are to be shown on the chart.

The chart is prepared in duplicate, one copy to be retained by the division engineer and the other for the use of the supervisor. Upon his return to headquarters, the supervisor transmits the program to the foreman by means of work orders, giving him the program for the entire month, or any part of it, as he may see fit. For this purpose a work order, or dispatch book, is provided. The book is bound in stiffback, note-book form, and contains 100 perforated leaves.

The work order is made out in duplicate, the carbon copy being filed on the dispatch board, serving as a ready reference showing the work being done by each gang and where working. The work order states the kind, location, amount of work to be done and the time to be consumed. Upon completion of the work the foreman dates and signs the order and returns same to the supervisor. The foreman is given a work order for all work to be done. This, however, does not relieve him of the responsibility of making unforeseen and emergency repairs.

(4) Form and Reports

For the purpose of recording the performance of the gangs two forms are used—one, a Daily Record of Track Work Performance, the other, a Monthly Record of Track Work Efficiency.

The result of each day's work as sent in by each foreman on the Daily Time Report is posted on the Daily Record Sheet, and the efficiency per cent of the day computed.

At the close of the month the "Monthly Record of Track Work Efficiency" is compiled from the totals of the "Daily Record." The monthly record shows the percentage of efficiency made by every gang on each class of work, the average of every gang on all work, and the average for the supervisor's subdivision—in other words, a detailed and an accurate record of the actual performance of every gang as compared with the standard performance. The "Standard" divided by the "Actual" gives the efficiency per cent.

The supervisors should not be required to handle the details of the operation of this system, as it is impossible for them to do so in addition to their regular duties. Each supervisor should be given an assistant, who devotes his entire time to the study of standard schedules and methods, to the recording and study of performances, to the instruction of the foremen in regard to standard practice, and to checking in the field the reports of work done to guard against errors.

(5) Force Distribution

Incidental to standard methods in maintenance of way work is the feature which will provide for an equitable distribution of the available track force to the various sections. A procedure which the committee suggests for consideration is the reduction of all features of track to the equivalent of one mile of first main track. A table of values, derived from actual costs extending over a period of years, for a main line division which was subject of special study, follows:

One mile of first main track equivalent to:

1.15 miles of second main track;
1.33 miles of third or fourth main track;
2.00 miles of branch line track;
2.00 miles of passing and thoroughfare track;
3.33 miles of yard tracks;
12 main track switches;
20 side track switches;
10 railroad crossings;
12 city street crossings;
25 to 50 county road crossings;
½ miles track pans;
4 miles ditches.

For the purpose of elasticity in use of the above form to meet the changing conditions of various elements of the track, it is suggested that the condition of the main elements per section be stated monthly and a "Condition Per Cent" of the whole section determined. This result applied to the equivalent mileage of the preceding form gives the equated mileage for the section. The ratio of the equated mileage of the section to the total equated mileage of the division determines the number of men to be allotted to that section from the total number of men allotted the division. A form for noting "Condition Per Cent" per section shows tentative relative values for certain elements of track as determined from an analysis of the records of previous years modified so as to meet the renewal program and other seasonal work.

This force distribution plan is a product of the application of standard methods and schedules, and is a development of the methodical direction and measurement of track work. It is described herein simply to indicate the form in which it may be developed.

RECOMMENDATIONS

(1) That the main feature of this plan, as described in—

Section 1—Standard Methods and Schedules.

Section 2—Instructions to Foremen.

Section 3—Planning and Dispatching.

Section 4—Forms and Reports; also some supplementary matter, designated as Exhibits "A" to "H," inclusive, be adopted and published in the Manual.

(2) That Section 5—Force Distribution be received as information.

Discussion

This report was presented by Chairman Johnston.

E. A. Frink (S. A. L.): I would like to inquire whether the committee in conclusion number 3 means that some one officer, or some one organization should be entrusted with the matter of selecting and supervising the employees of the entire system. If that is what it means, it is open to objection, because it does not seem to me a central organization could handle the question of obtaining track labor and mechanical repair men and bridge men so well as the organizations that are right on the ground.

Chairman Johnston: It means that an executive or general officer should be charged with the responsibility of looking after that important part of the business, centralizing it so that it may be run as an important part of the business. It means that this one man will be at the head of the organization which will bring about these results.

Maurice Coburn (Penna.): We have had many discussions about methods of selecting employees, and whether intelligence tests, such as those the army uses should be adopted by us. Has the committee discussed this to any extent?

Chairman Johnston: The committee has discussed that feature a great deal, and its conclusion with respect to it is that each line must handle its individual conditions.

W. D. Faucette (S. A. L.): I would like the chairman to explain how he understands the machinery of conclusion 3 would work. Suppose the officer who is to supervise the selection of men is 1,000 miles away from where the men are to select, tracklaying gangs, bridge gangs, crane gangs, clerical help, etc.

Chairman Johnston: This man would be head of a personnel department. He would not personally supervise the employment of men 1,000 miles away, but he would get a record of their physical examination and other data. He could lay down the particular section of the line on which a certain number of men would be required during certain seasons of the year, and he could be in touch with the executive who shifts the men from place to place.

Mr. Frink: This subject is of sufficient importance to be gone into a little further than the committee has gone in recommendation No. 3. I agree that the matter should be supervised by a central authority, but if the committee would map out how that can be best accomplished it would be much more helpful.

Chairman Johnston: We feel this way about the matter—this is the result of some few years' study of this problem, and to cover it generally is about as far as the committee feels it should go.

C. E. Lindsay (N. Y. C.): The subject is one of great importance, not only for the present maintenance of way organizations but for such organizations in the future. The past four years has given emphasis to seniority rights. Therefore, it behooves us to lay the foundation now for a system which will allow only those to enter the service who give promise of development and adaptability to the service that is necessary.

Chairman Johnston: *I move that the Conclusions on Subject A be adopted and published in the Manual. (Motion carried.)*

Chairman Johnston: The next is report upon methods for training and educating employees in engineering and maintenance work.

J. R. W. Ambrose (Toronto Term.): *I move the adoption and placing in the Manual.*

J. A. Stocker (T. & O. C.): Concerning the remarks in regard to the treatment of the young engineer. It occurs to me that many of us who are at the heads of the engineering departments forget how we felt as we came on up the line, and do not do our full duty towards these men along the lines of training and encouragement. Most of us are standing between our organizations and a superior, the president, vice-president or general manager, who may not appreciate the conditions, may not realize the value of training competent engineers, and I wonder whether we always do what we should do to present the case of the organization to the superior who controls our actions, and incidentally the treatment of all of these men?

Mr. Lindsay: I have listened carefully to your opening address, Mr. Chairman, and I was impressed with it. When a young man puts his foot on the bottom of the ladder in entering the railroad service, he should or must look to the top. If the railroad will have a well-defined ladder for an engineer entering the service, it will save them much trouble and will give great benefit to the engineer.

W. H. Courtenay (L. & N.): If a young man is charged with any investigation and makes a report, and the report is exceptionally good, it has been my practice when reporting to my superior to submit the young man's report. It gives the management some idea of the ability of the men in the engineering department; and it is fair to the young man.

Prof. A. N. Talbot (U. of Ill.): I am particularly pleased with the committee's recommendation concerning the training and education of the younger men, and the necessity for them taking part in conferences and having more responsibility.

W. L. R. Haines (Penna.): I think that Mr. Courtenay's suggestion that the report of the young engineer should be forwarded needs a little supplementing. When the young engineer makes a report which for some reason cannot be followed, he should be advised in what

respect his report or recommendation is faulty. That is quite as much a part of his education as any other part of his education.

H. T. Porter (B. & L. E.): When a young man enters our employ, I generally have a little conversation with him and I say to him: "Now if at any time you find that you are not getting along as fast as you would like to, and you hear of an opportunity of doing better elsewhere, you can follow this matter up openly, because I promise you that I am ready to help you."

R. H. Ford (C. R. I. & P.): Departmentalism is one of the features which works to the detriment of the average young engineer. The engineer from his training is more of a technical man, and too frequently his superior officer holds him too long on those features of work. Unless the young engineer can have an opportunity to display his talents other than in the narrow lines of the engineering departments, he will not get very far.

The committee this year in discussing this subject gave this a great deal of consideration, and you will note in its conclusions that they also give a great deal of weight to other departments.

P. H. Winchester (N. Y. C.) (after reviewing the circumstances attending railway employment at some length concluded as follows.) If the committee had presented nothing else outside of its six conclusions, I think its work has been well spent. They embody ideas that have not been presented on this floor in all the years of the history of this association. Ideas as forcible, as pertinent to the upbuilding and training of engineers in the railroad service, have never been presented before.

(The motion to adopt the conclusions on subject A was carried.) (Chairman Johnston then read the conclusions on Subject B.)

Chairman Johnston: The committee recommends that these conclusions be adopted and published in the Manual.

(The motion was carried.)

(Earl Stimson (B. & O.) then presented the portion of the report covered in Appendix C and moved that action be taken by the meeting as outlined in the "Recommendatitons." The motion was carried and the committee excused.)

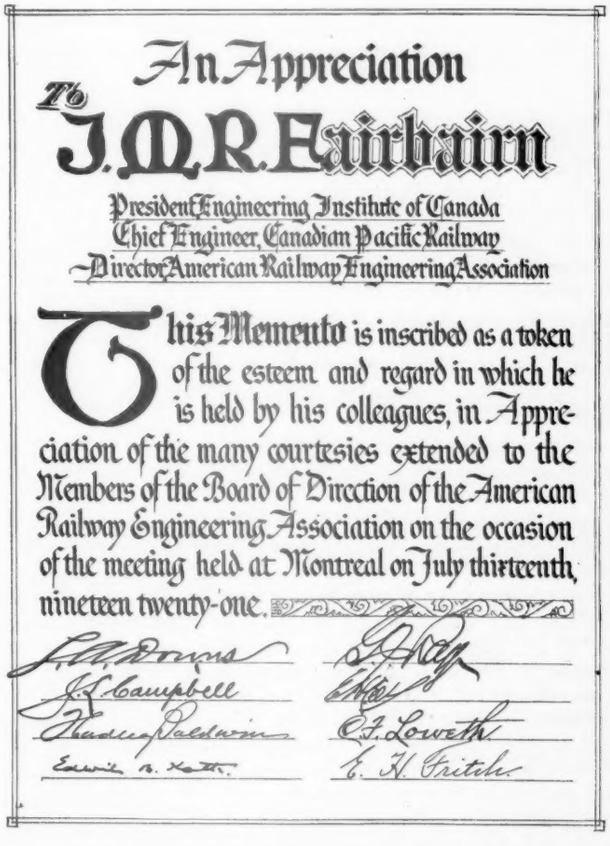
Hearings Before the Labor Board

HEARINGS ON THE REQUESTS of practically all of the larger railroads of the country for reductions in the rates of pay of various classes of railway employees, including those in the maintenance of way department, are now being held before the Railroad Labor Board at its rooms in the Kesner building, Madison street and Wabash avenue. These hearings were opened on March 6, but because of a ruling made by the Board at that time, the discussion of rates of pay of maintenance of way workers will probably not begin until next week.

The opening statement of J. W. Higgins, executive secretary of the Association of Western Railways, however, contains an indication of the decreases in the pay of maintenance of way workers which are being sought at this time by the western railroads. Mr. Higgins, on behalf of 101 western carriers, at that time asked that authority be given these railroads to pay the prevailing rates in the territory employed for track and common labor in the maintenance of way department, now being paid from 28 to 40 cents per hour; for laborers around shops, now being paid from 31 to 43 cents per hour; for station and platform employees, now being paid from 37 to 49 cents per hour; and for common labor in station forces now receiving from 28 to 40 cents per hour. Mr. Higgins also asked for authority to pay drawbridge tenders and assistants, now receiving $75 a month, the prevailing rates in the territory in which they are employed. For mechanics in the maintenance of way and bridge and building departments, Mr. Higgins asked for a decrease of 5 cents per hour, the proposed new rate being 53 cents per hour, as compared with the present rate of 58 cents per hour. Other decreases requested by Mr. Higgins on behalf of the western carriers include mechanics' helpers, maintenance of way and bridge and building departments, from 44 cents to 36½ cents per hour; boiler room, water tenders and coal passers, from 35-40 cents to 31-42 cents per hour; signalmen, leading maintainers, gang foremen, etc., 78 to 72½ cents per hour; signalmen and signal maintainers, from 73 cents to 60-67½ cents per hour, and assistant signalmen and assistant signal maintainers, from 54-68 cents to 40-54 cents per hour.

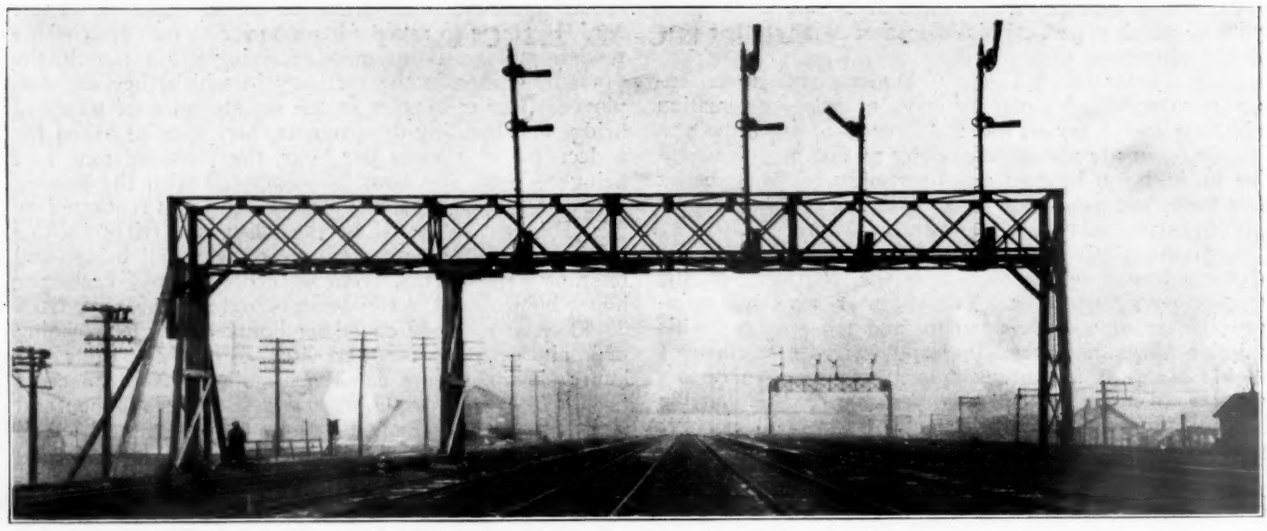
Presentation to Mr. Fairbairn

AT THE INVITATION OF J. M. R. FAIRBAIRN, director of the American Railway Engineering Association and chief engineer of the Canadian Pacific, the Board of Direction of the A. R. E. A. held its midsummer meeting at Montreal, Que., on July 13, at which



A Copy of the Expression of Appreciation

time those in attendance were the recipients of many courtesies extended by Mr. Fairbairn and his engineering colleagues of that city. At a later meeting of the Board of Direction in New York in November a beautifully engrossed expression of appreciation of this hospitality, autographed by those members of the Board who were present at the meeting, was presented to Mr. Fairbairn, a copy of which is shown herewith.



Signal Bridge, Chicago Terminal, Supported on Timbers as the Result of Recent Derailment.

Signal Section Concludes Its March Stated Meeting

Proposed Regulations Presented at Meeting for Government and Guidance of Signal Section

IMMEDIATELY AFTER THE OPENING of the session yesterday morning, Chairman F. B. Wiegand called on W. J. Eck, signal and electrical superintendent, Southern Ry., as chairman of the sub-committee of the Committee of Direction to report on the proposed regulations for the government and guidance of the Signal section which had been prepared by this sub-committee. In presenting these, Mr. Eck said that they are based largely on the constitution of the old Railway Signal Association and that the internal organization of the Signal section will be practically the same as that which was so successful with the R. S. A. during the existence of this body.

In the proposed regulations it is suggested that the membership of the Signal section shall consist of six classes—representative, representative of member, railway affiliated, affiliated, life and honorary. The regulations then defined the eligibility required for the various classes of members. The annual fee for railway affiliated members, which is to cover the cost of Advance Notices and Proceedings, shall be $3; and for affiliated members, $6; while representatives, representatives of members, life and honorary members will pay no fees. The officers of the Signal section shall consist of the chairman, a first vice-chairman, a second vice-chairman and a secretary. These officers in addition to three directors are to be elected at each annual meeting from the representative and representative of members.

The Committee of Direction will consist of a chairman, first and second vice-chairmen and nine directors, together with the three latest past chairmen. The term of office for the chairman and vice-chairmen will be one year, while that of the directors will be three years. The regulations then specify the way in which the election of officers is to take place, and how the affairs of the Signal section are to be handled. The way in which the various committees are appointed and work to be assigned is specified. Meetings of the Signal section are to be held at a time and place to be fixed each year by the Committee of Direction. The method in which business is to be handled is specified and the manner in which amendments must be presented is outlined.

Report on Economics

The Committee on Economics of Railway Signaling presented a progress report. This committee was appointed at the meeting of the Committee of Direction, Nov. 17, 1921. Three committee meetings have been held to organize the sub-committees, and the following committee assignments as indicated below have been made:

1. To determine the relative economic value of railway signaling as a means for protecting and directing the movement of trains and for reducing the cost of operation.

This will require the sub-committee to determine upon methods of procedure, roads to be studied, select the men to make the studies, compare results and submit a report covering the results of train operation as outlined in the assignment. On account of the large mileage of single track, there being over 200,000 miles in the United States, of which only 9 per cent is equipped with automatic block signals, the first studies of the committee should be confined to single track.

2. Study avoidable train delays, their causes and cost. Also report on delays at non-operated passing switches and the economic advantages of operating these switches by the installation of interlocking plants or low voltage switch machines.

3. Single track operation by signal indication, with particular reference to train orders, train order signals, train despatching, and block signal systems.

Committee: B. T. Anderson (D. L. & W.), Chairman; F. L. Dodgson (Gen. Ry. Sig. Co.), W. M. Post (P. R. R.), F. W. Pfleging (U. P.), J. A. Peabody (C. & N W.), H. M. Sperry (Publicity Representative), W. E. Boland (S. P.), A. R. Fugina (L. & N.), E. B. De Meritt (C. of Ga.), and G. S. Pflasterer (N C. & St. L.).

Report of Committee on Electrical Testing

The new specifications for testing direct current relays present for the first time a complete set of directions and data on this subject. Definite limits of contact opening, armature end-play and air gap are set. Exacting methods of testing the pick-up and drop-away are given for the direction of shop and field inspectors. In the past the railroads have in some cases depended too much on the personal experience of the inspectors to judge the proper limits to be used in checking relay operation, therefore these new specifications will answer a real need in the field by producing safer signal operation and therefore better train operation.

P. M. Gault
Chairman

P. M. Gault has been chairman of the committee for four years, and a member since 1915. His connection with the Railway Signal Association dates back to 1909, while he has a record of membership on two committees antedating his assignment to this one. Mr. Gault has seen service with two railroads. From 1906 to 1913 he was in the signal department of the Pennsylvania Lines, and since that year with the Illinois Central. In addition to a general field experience in signaling he served as pilot signal engineer and assistant engineer in the valuation department of the Illinois Central from 1917 to December, 1920, when he was made office engineer.

THE COMMITTEE SUBMITTED: 1. Instructions for inspecting and testing d.c. relays and indicators. 2. Method of testing first range d.c. bottom of mast, upper quadrant, motor signals, push clear type, in service. 3. Method of testing first range, upper quadrant, d.c. motor signals, top mast or bottom of mast types, having pull clear connections.

Instructions for Inspecting and Testing Direct Current Relays and Indicators.*

SHOP TESTS AND INSPECTIONS

1. Coils.—(a) At 20 degrees C., 68 degrees F., the percentage variation in the resistance of individual coils must not exceed: For 5 ohms, or less, plus or minus, 5 per cent. Above 5 ohms, plus or minus, 10 per cent.

(b) When in place, coils must be fixed to prevent vibration.

2. Binding Posts.—(a) Right or left hand coil terminal, as specified, must be marked plus (+) and used for positive connections.

3. Flexible Connections.—(a) Flexible conductor connecting binding post and contact finger must be formed and attached so as not to affect the pickup or dropaway of the armature.

4. Contacts.—(a) Flexible part of fingers must be stiff enough to exert a contact pressure of not less than 1 oz. when armature is against the stop pin.

(b) Finger contacts must meet contact surfaces squarely and simultaneously.

(c) Finger contact must have a horizontal contact slide movement of not less than .010 in. against contact surfaces.

(d) Metal support of the non-fusible contact element must be not less than 1/16 in. from the contact surface.

(e) Opening between finger contact and back contact surface, with front contact just closed, must be not less than .020 in.

(f) Front and polar contact openings for first range voltage must be not less than .050 in.

(g) Front contact opening for second range voltage must be not less than .090 in.

(h) Back contact opening for first range voltage with "working current or voltage" applied must be not less than .040 in.

(i) The initial cleaned contact resistance when relay is energized at "working current or voltage" must not exceed the following: Metal to metal, .03 ohm per contact; metal to carbon, .18 ohm per contact; carbon to carbon, .40 ohm per contact.

5. Armature End Play.—(a) Armature end play must be not less than .010 in. and not more than .020 in.

6. Air Gap.—(a) Relays with adjustable stop pins. 1. A minimum working magnetic air gap (both neutral and polar) of .020 in. for a relay with two neutral contacts, and of .015 in. for a relay with three or four neutral contacts must be maintained by an adjustable hard drawn phosphor bronze stop pin so placed that its position relative to the cores will be fixed and so that when armature is picked up it will strike against the stop near the edge farthest from the bearings and midway between the cores. The physical working air gap (both neutral and polar) must be not less than .018 in. for a relay with two neutral contacts and .013 in. for a relay with three or four neutral contacts. 2. A non-adjustable stop pin of phosphor bronze must be placed near each core near the edge farthest from the bearings protruding .010 in. from the under side of the core or the upper side of the armature for safety purposes.

(b) Relays without adjustable stop pins. The minimum working magnetic air gap (both neutral and polar) of .020 in. for a relay with two neutral contacts, and .015 in. for a relay with three or four neutral contacts must be maintained by two non-adjustable hard drawn phosphor bronze stop pins. The physical working air gap (both neutral and polar) must be not less than .018 in. for a relay with two neutral contacts and .013 in. for relay with three or four neutral contacts.

7. Gaskets.—(a) Defective gaskets must be replaced.

8. Case.—(a) Case must be so fixed as to insure a minimum clearance of ⅛ in. between it and movable parts.

9. Meter Calibration.—(a) Meters for shop use must be calibrated monthly.

10. Repairing.—(a) Test relay for defects, giving special attention to those noted on repair tag A. R. A. Signal section form 14. Make repairs and adjustments. Make and record test, A. R. A. Signal section form 10.

11. Testing.—(a) Pickup and dropaway must be determined as follows: 1. Initial charge. (a) Initial charge as specified on table No. 1, must be applied to coils for one minute.

2. Dropaway. (a) The initial charge must be applied to coils, then gradually reduced to the value at which front contacts open. This value is the dropaway with contact pressure.

3. Direct pickup. (a) Apply initial charge and take dropaway readings, then open circuit and again apply current to coils and gradually increase until front contact just closes. This value is direct pickup.

4. Reverse pickup. (a) Apply initial charge to coils in normal direction and decrease to zero. Reverse polarity and gradually increase energy to value at which front contact closes.

5. Direct working current or voltage. (a) Apply initial charge to coils in normal direction and decrease to zero. Gradually increase energy in same direction to value required to bring armature against stop pin.

6. Reverse working current or voltage. (a) Apply initial charge to coils in normal direction and decrease to zero. Reverse polarity and gradually increase energy to value required to bring armature against stop pin.

7. Polar pickup. (a) Without current in either direction, polarized armature with or without contact pressure must not move to the position opposite the last position operated. The current or voltage required to reverse the position of the polarized armature will be the polarized pickup.

8. Polar working current or voltage. (a) The value required to bring polar armature against stop pin in either operating position is the polar working current or voltage.

(b) Relay operating requirements must be in accordance with Table 1.

(c) In taking current readings the voltmeter should always be disconnected. In taking voltage readings the voltmeter should be directly across the coils of the instruments.

(d) Tests as required by A. R. A. Signal section form 11 and

*The term "relay" where used in these instructions includes indicators other than switch indicators.

A. R. A. Signal section forms 12 and 13 must be made and recorded at time relay is tested.

(e) Front, back and polar contacts of relays must be tested for contact resistance after case is in place and before relay is sealed.

(f) Insulation tests must be made between binding posts and relay tops. The insulation resistance must be not less than 1 megohm.

(g) In determining the resistance of coils or contacts by ammeter and voltmeter method, simultaneous reading should be taken of current and voltage.

12. Inspection.—(a) Determine by actual operation that relay has a positive dropaway and relay contacts open without retardation of movement due to friction or external force.

(b) Before the case is placed, subject the relay to air blast to remove any foreign matter, then check to see that all parts are in proper position and in good condition.

13. Sealing.—(a) Relay case must be sealed.

14. Final Test.—(a) After relay is sealed, final dropaway, pickup and working current test should be made. The values obtained should not vary more than 2 per cent from those of the previous test.

15. Shipping.—(a) Relays must be tested and must meet ship requirements before shipment.

(b) Each relay must be put in a separate carton or suitably wrapped before being placed in packing box.

Field Tests and Inspections

16. Meter Calibration.—(a) Meters must be calibrated before each cycle of test and as often as necessary for field use.

17. Testing.—(a) Test required by Sections 11-(f) and 12-(a) and A. R. A. Signal section form 11 must be made annually.

18. Inspection.—(a) Relays must meet shop requirements when placed in service, except in emergency, when relays meeting field requirements may be used.

(b) It must be determined by observation that sufficient front, back and polar contact opening exists.

(c) Determine by observing operation of relay, that sufficient clearance exists between case and movable parts.

(d) Parts enclosed must be free from foreign matter, in proper position and in good condition.

(e) Relays not meeting field requirements must be taken from service as promply as possible.

19. Repairing.—(a) Emergency repairs and adjustment to insure positive operation of relay, for temporary use in emergency, may be made in the field by an authorized relay inspector.

20. Recording.—(a) Relays must be identified by serial number, which must be recorded. Manufacturer's serial number must be used if available.

(b) Inspectors must re-mark indistinct serial numbers.

(c) Relays that have illegible or no serial number must be assigned serial number, preceded by a letter. The letter to be used will be assigned by .....

(d) Inspectors must immediately record field readings on A. R. A. Signal section form 11, which, when filled, must be forwarded to .....

(e) Field readings must be transferred weekly from A. R. A. Signal section form 11 to A. R. A. Signal section form 10. One A. R. A. Signal section form 10 must be used for each relay.

The committee recommended that the instructions for inspecting and testing direct current relays and indicators be approved for presentation at the annual meeting.

Committee: P. M. Gault (I. C.), chairman; J. S. Gensheimer (P. R. R.), vice-chairman; Harry Combs (L. E. & W.), Caleb Drake (C. & N. W.), C. E. Earhart (A. & V.), Thos. Holt (C. U. D. Co.), E. E. Ireland (C. I. & L.), Malcolm McIntyre (M. C.), F. D. Morehart (C. M. & St. P.), J. P. Muller (Southern), T. J. O'Meara (N. Y. C.), C. O. Seifert (B. & O.), E. B. Smith (N. Y. C.), L. L. Whitcomb (N. Y. C.), G. H. Person (B. R. & P.).

Discussion

A. R. Fugina (L. & N.): The relay specification does not provide for a non-adjustable pin.

E. B. Smith (N. Y. C.): There are relays in service with adjustable stop pins and a lot with non-adjustable.

E. T. Ambach (B. & O.): What did the committee have in mind when they require a meter calibration to be made monthly? What kind of calibration do you expect to make, a shop calibration or a manufacturers' calibration?

P. M. Gault (Chairman): It was the intention of the committee that that would mean that the meter should be compared with some other meter that is known to be correct.

Mr. Ambach: Referring to Table No. 1 the initial charge is shown as four times the direct pick-up. Now, under the shop requirements, what is this direct pick-up, with or without contact pressure? If the recommendations of Committee VII, which were accepted yesterday on operating characteristics of relays, are to be used in this particular instance it would mean a saturation of 393 mils against the recommendation of Committee VII of 450 mils. On the 2-ohm relay it is essential that you have 450 mils in order to get contact pressure on your fingers.

J. S. Gensheimer (Penna.): The initial charge in checking most of the relays against the present relay specification works out very well on four times the direct pick-up. This was checked with the manufacturers when this table was tentatively agreed upon.

S. M. Day (Gen. Ry. Sig. Co.): In 8-G, it states that simultaneous readings should be taken of current and voltage. If you take a simultaneous reading of current and voltage you are going to be led into error because your ammeter will indicate the current by the volt.

Chairman Gault: The committee will consider Mr. Day's suggestion.

G. K. Thomas (A. T. & S. F.): If the committee would make a definite recommendation as to the box in which the relays should be shipped, how it should be packed and going into details of that kind, it would help.

Mr. Gensheimer: The committee did go into that and found that several methods were suitable but we did not feel we should pick any one of those methods as the only method of shipping a relay.

Mr. Fugina: Referring to Table 1, the dropaway for motor contact states, "not less than 65 per cent of the original marking nor less than 35 per cent of pick-up—" I wonder why we have two values? I think the 70 per cent of the original marking is the proper value to use.

Mr. Gensheimer: To make that more accurate, it should say 70 per cent and the other one, I agree, it really should be 33⅓. I worked it out that 33⅓ and 70 will agree. The object of specifying the two was so that your direct pick-up would not increase on your drop-away figures.

Mr. Fugina: Will the committee take into consideration then to use the value of 33?

Chairman Gault: The committee will consider that.

Mr. Fugina: Under 5-B of the Method of Testing First Range, Upper Quadrant, D. C. Motor Signals, it seems to me the wording "45-deg. position" could be eliminated. I do not believe you could make a test without having a 45-deg. position.

Chairman Gault: The committee will consider that.

Mr. Fugina: The specifications for the push-clear type are identical with those of the pull-clear type, except for a few tests. These two specifications could be combined by merely adding to the push-clear specification a clause at the end, that the following tests shall be made for the pull-clear type, and one paragraph in addition to 2-B, 2-E, 3-C and 4. Outside of this section, the two specifications are exactly identical.

Chairman Gault: The committee will consider the question of combining these instructions in one instruction.

(The instructions were approved for presentation at the annual meeting after which the committee was dismissed with the thanks of the Signal section.)

Report of Committee on Valuation

The average service life in years of the important units of the different types of signal installations is one of the most important questions occupying the attention of this committee. This has been a debated question between railroad and government forces from the time valuation work first started, as it is one on which little authentic information was to be had at that time. The committee presents the results of several years' study of the average service life of materials. A uniform method of reporting the materials used and the labor performed in construction has been a subject for careful study and suggested forms have been prepared.

J. M. Carley
Chairman

J. M. Carley was appointed chairman in December, 1918, when the committee was formed. He entered the service of the Lehigh Valley as a helper and telegraph operator in 1892, resigning in November, 1899, to go with the Buffalo, Rochester & Pittsburgh as a station agent. Two years later he went with the New York Central as a relief signalman. He served as one of the inspectors making a tentative valuation of signal equipment in 1911. Later Mr. Carley was transferred to the signal engineer's office at Albany, N. Y. In May, 1917, he accepted a position as signal estimator on the Boston & Albany, and is still engaged in valuation work.

THE COMMITTEE submitted for consideration reports on the average service life in years of the important units of the different types of signal installations and forms for reporting the distribution of signal labor and material charges and credits. The committee recommended that these reports be approved for presentation at the annual meeting.

Average Service Life of Signal Units

(Obsolescence not considered)

Unit.	Service Life Min.	Max.
Air compressor, steam	30	50
Air compressor, internal combustion	20	40
Air compressor, electric motor	40	60
Arms, cross, wood untreated	10	25
Arms, cross, treated	15	40
Arresters, lightning, under 600 V	20	50
Arresters, lightning, over 600 V	15	40
Bars, detector complete	10	20
Bars, deflecting	15	35
Batteries, portable storage	5	14
Batteries, stationary storage	6	25
Bells and buzzers	20	50
Bonding	5	20
Bonds, impedance	30	75
Brackets, signal	25	75
Bridges, signal	25	75
Cable, aerial, braided	15	40
Cable, aerial, lead sheath	25	60
Cable, aerial, steel sheath	20	50
Cable, submarine, armored	30	60
Cable, underground, braided	15	25
Cable, underground, lead sheath	25	50
Cable, underground, steel sheath	20	40
Carriers, pipe	20	50
Carriers, wire	20	50
Compensators	10	30
Conduit, clay	50	100
Conduit, concrete	50	100
Conduit, fibre	7	15
Conduit, fibre in concrete	25	50
Conduit, iron	20	50
Conduit, wood, untreated	7	15
Conduit, wood, treated	15	30
Concrete	50	100
Controllers, switch circuit	10	25
Controllers, all other circuit	25	50
Couplers, bridge (pipe and wire)	15	35
Cranks	10	30
Engines, internal combustion	20	40
Engines, steam	30	50
Foundations, concrete	50	100
Foundations, iron	20	40
Foundations, wood	10	25
Gates, highway crossing, electric	20	40
Gates, highway crossing, mechanical	20	40
Gates, highway crossing, pneumatic	20	40
Gates, railroad crossing, electric	20	40
Gates, railroad crossing, mechanical	20	40
Gates, railroad crossing, pneumatic	20	40
Generators, electric	30	75
Housings, concrete	..	100
Housings, iron	30	75
Housings, wood	10	25
Indicators, switch	30	60
Indicators, in buildings	30	75
Insulators, glass or porcelain	..	100
Insulation, pipe	25	50
Jaws	10	25
Layouts, mechanical switch or derail	8	40
Layouts, power switch or derail	10	50
Locks, bolt	25	50
Locks, electric, switch	15	35
Locks, electric, lever	25	50
Locks, plunger	20	50
Locks, time	30	75
Lugs	10	30
Machine, mechanical interlocking	25	60
Machine, power interlocking	30	50
Movements, mechanical switch	10	40
Movements, power switch	15	50
Motors	30	75
Pipe, galvanized iron signal	25	50
Pipe, galvanized steel signal	15	30
Pipe, black iron signal	25	50
Pipe, steel signal	10	20
Poles, wood signal	15	30
Poles, iron signal	25	75
Poles, wood cable	8	20
Poles, iron cable	15	50
Poles, line, untreated	15	45
Poles, line, treated butt	20	45
Poles, line, treated	25	60
Poles, line, concrete	50	100
Rectifiers (mercury arc)	30	60
Relays	20	50
Releases, electric clock work	20	75
Releases, mechanical	20	75
Screws, pipe adjusting	20	50
Screws, wire adjusting	20	50
Shafts, rocking, and fittings	25	60
Selectors, pipe or wire	20	50
Signals, mechanical, high	25	65
Signals, mechanical dwarf	20	40
Signals, power, high	25	75
Signals, power, dwarf	20	60
Switchboards and accessories	25	75
Terminals	40	75
Transformers	15	50
Trunking (see conduit).		
Wheels, chain	10	30
Wire, bare, copper	..	100
Wire, bare, copper clad	15	50
Wire, bare, iron	30	75
Wire, bare, steel	10	40

Wire, rubber-covered, copper, smaller than 12 A.W.G.	7	25
Wire, rubber-covered, copper, 12 A.W.G. and larger..	7	30
Wire, weatherproof	15	30
Wire, galvanized messenger, stranded.....	10	60
Wire, galvanized guy, stranded.....	10	40

Forms for Reporting Distribution of Signal Labor and Material Charges and Credits

Forms have been prepared to meet the requirements of Valuation Order No. 3 of the Interstate Commerce Commission, and, in addition, to provide for the allocation of costs, for estimating and statistical purposes, to the composite units shown to be printed on the back thereof. The use of the word "month" is merely as an example and the committee believes that the form may be used as a progressive or final statement or for such period as the supervising officer may elect, with practically the same results.

Where the word "Account" appears it will be understood to mean "Road and Equipment" (R. & E.), "Profit and Loss" (P. & L.), and Operation Expense Accounts, as shown in the classification of accounts for steam railroads, issued by the Interstate Commerce Commission, effective July 1, 1914.

Committee: J. M. Carley (B. & A.), chairman; C. Homewood (P. R. R.), vice-chairman; E. T. Ambach (B. & O.), B. T. Anderson (D. L. & W.), R. B. Arnold (C. & N. W.), G. E. Beck (N. Y. C.), P. M. Gault (I. C.), C. O. Glenwright (P. R. R.), W. J. Kocher (L. V.), G. W. Kydd (B. & O.), S. W. Law (N. P.), J. W. MacCormack (K. C. Term.), J. P. Robinson (S. P.), C. H. Wiegand (A. C. L.), J. P. Zahnen (C. R. I. & P.).

Discussion

Mr. Stevens: The report states "obsolescence not considered." Obsolescence is a big thing. It seems to be the opinion of some public utility people that some value might be arrived at for obsolescence to take care of the actual value of stuff in service.

J. M. Carley (B. & A.): The committee has never taken any action on the subject of obsolesence.

A. H. Rudd (Penna.): I would like to ask if the committee took into consideration at all wear and tear in connection with this minimum life, or if they arrive at this in some other way.

Chairman Carley: This table was based on minimum ages of apparatus being used in the service and operated continuously, with maintenance but without any accidents, or anything except normal and natural wear.

(Sections 4 and 5 were approved for presentation at the annual meeting after some recommended changes in the column heading of the latter. This committee was then dismissed with the thanks of the Signal section.)

Report of Committee on D. C. Track Circuits

A discussion of the factors involved in the standards of safety for track circuits is one subject of importance presented by this committee. The track circuit is the foundation on which modern signal practice is based and many have had an erroneous idea that because of its apparent simplicity there are no complex characteristics to be considered. In establishing track circuit standards, factors such as ballast and rail resistance, train shunt resistance, switch fouling resistance, switch box shunt resistance, insulated joint and switch rod resistance, battery, relay characteristics and limiting resistance between battery and track must be considered.

A. R. Fugina
Chairman

A. R. Fugina has been the chairman of this committee since its organization two years ago. The need for such a committee was shown by the research work inaugurated by Mr. Fugina on his lines, which made it apparent that there were many problems to be solved. His appointment as chairman is in recognition of this work. Mr. Fugina entered railroad service in engineering location work on the Chicago & North Western in western Minnesota early in 1899. In July, 1907, he was transferred to the signal department of this road as assistant engineer. In December, 1910, he was appointed signal engineer of the Louisville & Nashville.

THE FOLLOWING FACTORS involved in the safety of track circuits must be taken into consideration in the study of the track circuit and each has a vital bearing in establishing track circuit standards: Ballast resistance, rail resistance, train shunt resistance, switch touling resistance, switch box shunt resistance, insulated joint and insulated switch rod resistance, battery, characteristics of the relay, and the limiting resistance between the battery and track.

Values for the various factors must be such as will prove practicable, and these must correlate properly with each other. The value of one is dependent upon the value of the others, and therefore in order to fix upon a standard value for any one of the factors, we should know what effect such value will have on the other factors.

The effect of the train shunt and the limiting resistance between battery and track in a typical track circuit, assuming different conditions for the battery, ballast and the relay. The fundamental conditions should be such that a relay will open when the track is shunted, either by a train or an opened switch, and will pick up again when the shunt is removed. Assume a length of track circuit, 3,000 ft.; a 4 ohm 4 point track relay with R. S. A. pick-up; .078 amp. and drop-away .037; 3 cells caustic soda battery connected in multiple; gravel ballast reasonably well cleared from rails, and the resistance of the rails and bond wires 0.3 ohms. The limiting resistance between battery and rails, including the connecting wires, 2 ohm, this being within the R. S. A. recommended limit.

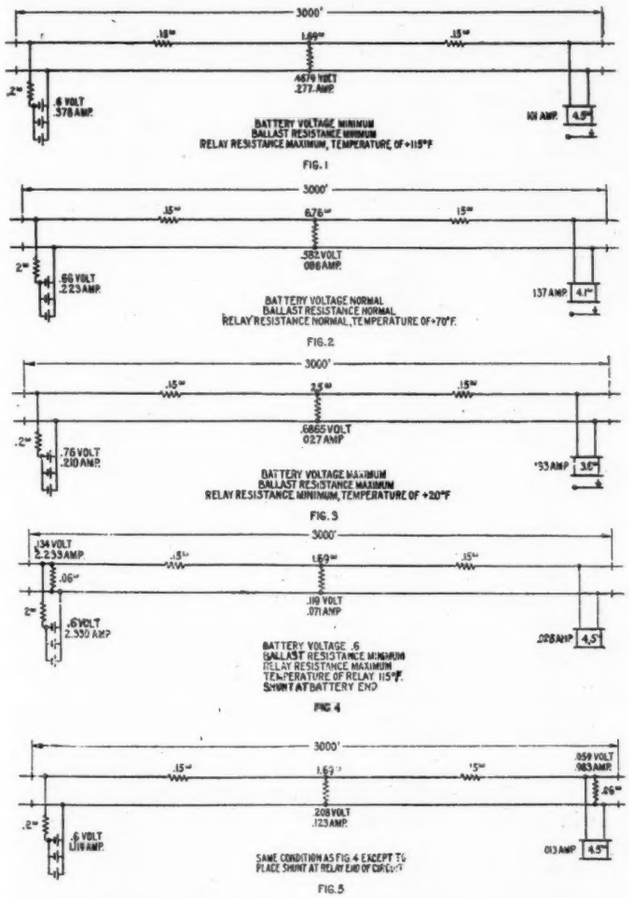
With these conditions we want to be assured that the relay will open when the track is shunted, and that the relay will again close when the shunt is removed.

It has been learned from experience that the adverse condition of battery, ballast and relay, as affecting the pick-up of the relay, are present at the beginning of a rain on a hot summer day after a dry spell, with the battery nearing exhaustion and the resistance of the coils of the relay higher than normal, due to high temperature. Under these conditions the current and voltage readings of the circuit will approximate those shown in Fig. 1.

In Fig. 1, as well as in all of the following figures, the resistance of the wire connections between relay and rail

is assumed to be .1 ohm, and this is included in the figure of 4.5 ohms for the relay. When all conditions of the circuit are normal, the current and voltage readings will approximate those shown in Fig. 2.

When all conditions of the circuit are favorable, for example, in the winter time with the ballast frozen, just after the battery has been renewed, the current and voltage readings will approximate those shown in Fig. 3.



Diagrams of Track Circuit Tests—Figs. 1 to 5

It will be noted that under the adverse conditions we have .101 amp. flowing through the relay as compared with .183 amp. under the most favorable conditions. With the adverse conditions the relay will pick up with sufficient slide on the contacts to properly close the line circuits. Let us now see if the relay will drop away when the track is shunted.

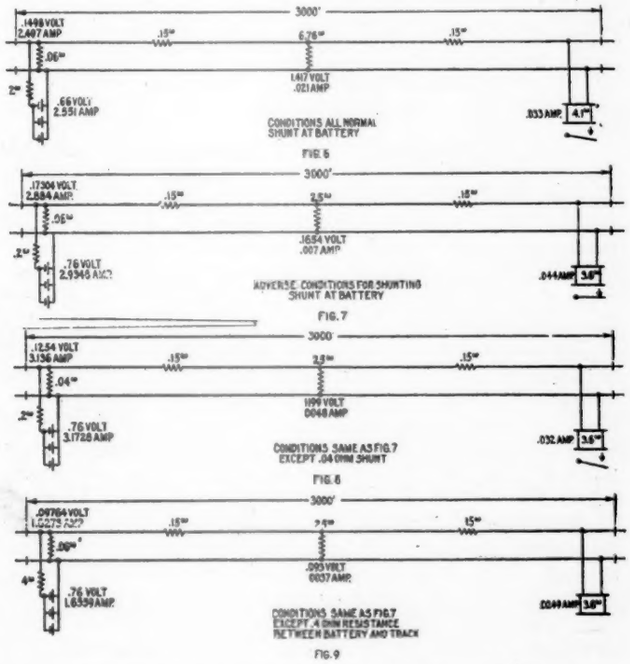
Under our assumption, the limiting resistance between the battery and the track is within the limit set by the R. S. A. standard for direct current track circuit safety. This standard is based on a train shunt of .06 ohm, which figure is used for the shunt in checking the circuit. Conditions are assumed for the circuit and battery as shown in Fig. 1. We will first place the .06 ohm shunt across the rails at the battery end of the circuit as indicated in Fig. 4, and then at the relay end, as shown in Fig. 5.

From Figs. 4 and 5 it will be noted that with the shunt at the battery end, the current flow through the relay is .026 amp., while with the shunt at the relay end the current flow through the relay is .013 amp. It is evident, therefore, that the shunt at the battery end is the more adverse as regards the shunting of the relay. In the following we will assume that the shunt will always be located at the battery end of the track circuit.

We will now assume conditions for the circuit and battery as shown in Fig. 2, which represents the normal condition, and will place a .06 ohm shunt across the rails. The results are illustrated in Fig. 6. Under Fig. 7 we assume the same conditions for the circuit and battery as shown in Fig. 3, which represents the adverse condition for shunting of the relay, with a .06 ohm shunt across the rails.

Therefore, under the three assumed conditions as shown in Figs. 4, 6 and 7, the following current flows respectively through the relay—.026 amp., .033 amp. and .044 amp. Under the last conditions with a .06 ohm shunt connected across the rails at the battery, there is a current flow of .044 amp. through the relay, whereas the R. S. A. drop-away value for the relay is .037 amp. The limiting resistance, shunt and battery voltage are within the standards as prescribed by the R. S. A., and yet there is enough current flowing through the relay to keep it from opening.

Obviously the R. S. A. standards should be adjusted, and apparently there are two ways to do it, namely: by reducing the resistance of the train shunt, or by increasing the resistance between the battery and track. The effect of using a .04 ohm train shunt instead of one of .06



Tests of D. C. Track Circuits—Figs. 6 to 9

ohm, is shown in Fig. 8, in which all conditions except the shunt are the same as given in Fig. 7.

Reducing the shunt from .06 ohm to .04 ohm reduces the current flow through the relay from .044 amp. to .032 amp. If a .02 ohm shunt is used, the current flow will be only .0175 amp. If instead of reducing the resistance of the train shunt we increase the limiting resistance between the battery and track from .2 ohm to .4 ohm we shall have the results shown in Fig. 9.

The increase of the limiting resistance from .2 to .4 ohm reduces the current flow through the relay from .044 amp. to .0249 amp. If a .6 ohm limiting resistance is used, the current flow through the relay will be reduced to .0174 amp.

In the foregoing the rail resistance has been considered

as a constant. To vary the rail resistance will, of course, give still different results.

D. C. Track Circuit Tests for Rail and Ballast Resistance

The formula for ballast resistance as printed in Committee IV's report on page 27 of the March, 1919, advance notice is in error. The formulæ for rail and ballast resistance as printed in Committee IV's report on pages A-52 and A-53 of the 1919 proceedings are correct. The formula for ballast resistance as printed in Committee V's report on page A-159 of 1920 proceedings is in error, while the formula on page 14 of the 1920 letter ballot covering the report of Committee V is correct.

The committee has prepared a form covering instructions for making measurements and computations for rail and ballast resistance and for recording the same, which it proposes to use for collecting data concerning rail and ballast resistance.

The committee recommends that the form for direct current track circuit rail and ballast resistance report be approved for presentation at the annual meeting, being meanwhile referred to Committee XIII, Electrical Testing.

Committee: A. R. Fugina (L. & N.), chairman; R. M. Phinney (C. & N. W.), vice-chairman; B. T. Anderson (D. L. & W.), H. H. Appleton (P. R. R.), F. W. Bender (C. R. R. N. J.), Dwight Byers (N. Y. C.), E. B. DeMeritt (C. of Ga.), R. E. Green (M. C.), H. G. Morgan (I. C.), D. S. Rice (L. V.), K. W. Spain (R. I.), W. S. Storms (Erie), J. B. Weigel (L. & N.), L. S. Werthmuller (Mo. Pac.), A. J. Yarrell (C. I. & L.).

Discussion

A. R. Fugina (Chairman): The committee presents the report for discussion more as a thesis, discussing the factors involved in the standards of safety of track circuits. This is merely submitted to the association as information.

F. L. Dodgson (Gen. Ry. Sig. Co.): I think you know what the 0.06-ohm shunt meant, and how it was arrived at. The committee has shown quite conclusively that if the shunt on the relay is 0.06 ohm, under certain conditions the relays will not be properly shunted. This value of 0.06 ohm, when it is applied to a single car, even on a running line, has a very large factor of safety, probably a factor of safety greater than 10; but when it is applied to a shunt on a side track or a shunt track, the factor of safety in some cases may be zero, in fact, really no shunt at all. I would suggest to the committee that in their further consideration of this subject they divide track circuits which have switch shunts in them or switches, and prepare a table of limiting resistances for track circuits which do not have switches, and which are always in the running rail, that is, the running rail is clean, and another table for track circuits in which there are switches and practically shunt tracks, and then consider what is going to happen in the shunt circuits under rusted rail conditions.

Chairman Fugina: The committee expects to present various tables of limiting resistances for various train shunts. I doubt very much whether we are going to be able to select a train shunt that will do for the side track fouling section, and will do for the main line. What we do attempt is to present a series of resistances that may be used on main line track, varying from 0.01 to 0.06 ohm, and then the engineer may take the table which he believes his standard will permit him to operate on. The present table of limiting resistances that is used will not hold good with the 0.06 train shunt.

A. J. Kelly (C. C. C. & St. L.): Where a 0.6-volt battery is used with a 2-ohm relay, the minimum allowable resistance, which is 0.3, is wrong. It is possible that you would have 0.5 volt at your relay. Now, transferring a 2-volt battery onto that same circuit, using the minimum allowable resistance, which is 1.1, you might have 2 volts or 5 mils flowing through. If it is not safe with the lower voltage battery, why is it with the 2-volt?

Chairman Fugina: Generally it will be found that the circuit will be safer with the higher voltage battery, because it is possible to cut in more limiting resistance between the battery and the track.

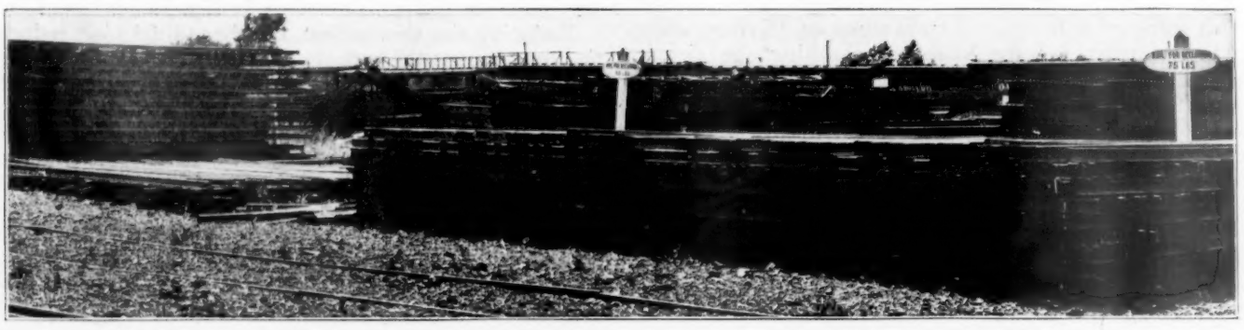
Mr. Kelly: Following the limiting resistance by the R. S. A., what is the guide to the maintainer? The maintainer is told that he may reduce his resistance to 1.1 ohms with a 2-volt battery and a 2-ohm relay, but by doing that it is possible he might get 500 mils through his relay.

Mr. Fugina: I stated before that the present table of limiting resistances is not correct for all values. With the 0.06 train shunt, the table of limiting resistance is all right. If the train shunt is different from that it will not work out.

S. M. Day (Gen. Ry. Sig. Co.): There are two ways, apparently, of adjusting the present R. S. A. standards, namely, by reducing the resistance in the train shunt, or by increasing the resistance between the battery and the track. That is perfectly correct, as far as it goes, but there are other ways still. One of the most important of them is to use a more efficient relay; in other words, if you use a relay which has a lower drop-away, cutting your minimum drop-away of a relay in service to a specified point which is higher than what it is now, a track circuit can be obtained which will give a much better characteristic.

Chairman Fugina: The committee appreciates that, but we have not a more efficient relay available; although we hope that we are going to get it.

(The report of the committee was approved for presentation at the annual meeting, after which the committee was dismissed with the thanks of the Signal section.)



Stock Piles of Relayer Rails

Report of Committee on Mechanical Interlocking

Concrete trunking, capping and supports are being used more extensively than formerly and the committee provided specifications covering the character of materials to be used and the workmanship necessary for a uniform product. The compensation of a pipe line is important, as the proper working of the operated unit depends on expansion and contraction being neutralized. The committee accordingly presented specifications and compensation charts pertaining to this work. The specifications for mechanical interlocking are brought up to date with the presentation of a revised specification in which is incorporated a requisite sheet covering construction.

Charles J. Kelloway
Chairman

Charles J. Kelloway is completing his twenty-fourth year as chairman of the committee, having held this office since the committee was organized, with the exception of the one year, 1920, during which he was chairman of the Signal division, A. R. A. As signal engineer of the Atlantic Coast Line he has had occasion to install and test out much of the mechanical interlocking apparatus recommended by the committee. Mr. Kelloway has also been in charge of the installation of the signaling and interlocking of the Jacksonville Terminal Company during the past three years. His untiring efforts have contributed largely to the excellent specifications produced.

THE COMMITTEE SUBMITTED specifications for concrete trunking, and unit specifications for universal compensation of pipe lines, together with drawings 1536; instructions for locating compensators, and compensating cranks 1537; compensation chart and 1538, crank chart, and revised specifications and requisite sheet for mechanical interlocking.

Specification for Concrete Trunking, Capping and Supports

(1) Purpose, (2) Drawings, (3) Material and Workmanship, are standard sections.

(4) Reinforcement.—(a) Reinforcing material shall be ¼ in. deformed square rod or its equivalent.

(5) Cement.—(a) The cement shall comply with specifications of the purchaser.

(6) Sand.—(a) Sand shall be clean, sharp and coarse. It shall be free from sticks and other foreign material, but may contain clay or loam not to exceed 5 per cent.

(7) Water.—(a) Water should be clean, fresh (not salt) and free from sewage or other impurities detrimental to the concrete.

(8) Stone or Gravel.—(a) Stone or gravel shall be sound, hard and durable and shall be clean and free from shale, dust, loam, clay or any foreign substances. If necessary to meet these requirements, broken stone shall be screened and washed. The size of pieces shall range from a minimum of ¼ in. to a maximum of ¾ in.

(9) Proportions.—(a) The concrete shall be mixed in the proportion of 1 part of cement to not more than 2 parts of sand and 2 parts of stone or gravel, measured separately.

(10) Mixing.—(a) The mixing shall be done in a machine of the batch type.

(b) Each batch to be mixed not less than 1 minute nor more than 1½ mins.

(11) Consistency.—(a) The material shall be wet mixed and of such consistency as to cause it to flow into a form and about the metal reinforcements without permitting a separation of the coarse aggregates from the mortar, while the concrete is being conveyed from the place of mixing to the forms.

(12) Placing of Concrete.—(a) The concrete shall be spaded along each surface of the form as it is deposited, to insure the smoothest possible finish. Every section shall be completely filled before any portion of the concrete has set.

(b) Concrete that has partially set or has been mixed 30 mins. shall not be used.

(13) Temperature.—(a) Concrete shall not be mixed or placed when the temperature is below 40 degrees F.

(14) Forms.—(a) The forms shall be substantially built in such manner that the product shall conform accurately to the measurements as specified on drawings. The forms shall be water-tight and shall be coated with oil or grease to prevent adhesion to the concrete. The oil or grease shall be of such character that it will not discolor the concrete.

(15) Removing Forms.—(a) Forms shall not be removed until the concrete has attained a set sufficiently hard to prevent its adhering to the forms when they are removed.

(16) Tests, (a), (b), (c) and (d) are according to standard sections.

(f) Material shall be cured not less than 28 days before testing. Trunking shall be supported for a distance of 3 in. at each end. Where side walls are 5 in. high, outside dimensions, it shall support a weight of 500 lb., concentrated within 12 in. in the center, without showing cracks. Where side walls are 6⅞ in. high, outside measurement, it shall support a weight of 800 lb., concentrated within 12 in. in the center, without showing cracks.

(17) Finishing.—(a) Before concrete is fully set, all sharp edges shall be removed.

(18) Outlets.—(a) Outlets for branch leads, when specified, shall be provided when pouring concrete, using blocks of the size required to admit branch leads.

(19) Finished Product.—(a) Trunking and capping shall be true to form and have a uniform thickness throughout not varying in thickness from drawings more than ⅛ in.

(20) Curing.—(a) Upon removal of the forms the finished product shall be protected from the direct rays of the sun and wind for a period of 48 hr. and shall be kept wet by sprinkling for at least 7 days. The temperature of the air in which the curing is done shall be maintained above 40 degrees F., 4.44 degrees C., but artificial heat exceeding 110 degrees F. shall not be used.

(21) Inspection, (22) Packing, (23) Marking, and (24) Warranty, are standard sections.

The committee recommended that the specifications for concrete trunking, capping and supports be approved for presentation at the annual meeting for submission to letter ballot for inclusion in the Manual.

Specification for Universal Compensation of Pipe Line

(1) Purpose.—(a) The purpose of this specification is to provide for universal compensation of pipe line.

(2) Details of Work.—(a) Details of work are to be as herein described.

(3) General.—(a) Compensators shall be in accordance with R. S. A. 1013, 1014 and 1231, unless otherwise specified on requisite sheet.

(b) Drawing 1536, instructions for locating compensators and compensating cranks, shall govern: 1. Location of compensators and compensating cranks. 2. Reduction of stroke of cranks (note 1). 3. Determination of distance "B" (note 2).

(c) In connecting pipe to compensator, be governed by compensation chart 1537.

(d) In territory where temperature variation is less than 120 degrees F., compensation shall be provided for each pipe line as follows:

1. For switches, movable frogs and point derails with 10x13-in. compensator cranks.

For 8¾-in. stroke, lengths 40 to 800 ft.

For 9¾-in. stroke, lengths 40 to 600 ft.

2. For facing joint locks, switch and lock movements, lift derails and signals, with 10x13-in. compensator cranks.

For 8¾-in. stroke, lengths 80 to 800 ft.

For 9¼-in. stroke, lengths 80 to 900 ft.

3. For switches, movable frogs and point derails with 10x16-

in. compensator cranks, unless otherwise specified on requisite sheet.

For 8¾-in. stroke, lengths 40 to 1100 ft.

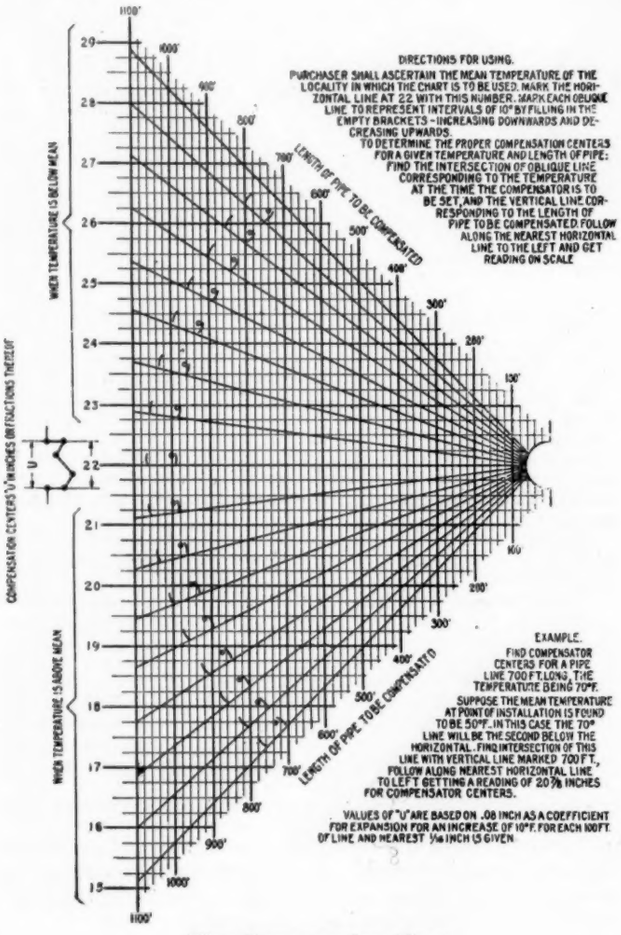
For 9¾-in. stroke, lengths 40 to 900 ft.

4. For facing point locks, switch and lock movements, lift derails and signals, with 10x16-in. compensator cranks, unless otherwise specified on requisite sheet.

For 8¾-in. stroke, lengths 80 to 1100 ft.

For 9¾-in. stroke, lengths 880 to 900 ft.

(e) In territory where the temperature variation is more than 120 degrees F., compensation shall be provided for each pipe line as follows:



Pipe Compensation Chart

1. For switches, movable frogs and point derails with 10x13-in. compensator cranks.

For 8¾-in. stroke, lengths 40 to 700 ft.

For 9¾-in. stroke, lengths 40 to 500 ft.

2. For facing point locks, switch and lock movements, lift derails and signals, with 10x13-in. compensator cranks.

For 8¾-in. stroke, lengths 80 to 700 ft.

For 9¾-in. stroke, lengths 80 to 500 ft.

3. For switches, movable frogs and point derails with 10x16-in. compensator cranks, unless otherwise specified on requisite sheet.

For 8¾-in. stroke, lengths 40 to 1000 ft.

For 9¾-in. stroke, lengths 40 to 800 ft.

4. For facing point locks, switch and lock movements, lift derails and signals with 10x16-in. compensator cranks, unless otherwise specified on requisite sheet.

For 8¾-in. stroke, lengths 80 to 1000 ft.

For 9¾-in. stroke, lengths 80 to 800 ft.

(f) Horizontal cranks shall be in accordance with R. S. A. 1011.

(g) Crank chart 1538 shall govern the setting of cranks in regard to temperature.

(h) In territory where temperature variation is less than 120 degrees F., and cranks with 11¾x11¾-in. arms are used, compensation shall be provided for each pipe line as follows:

For 8¾-in. stroke, lengths 550 ft.

For 9¾-in. stroke, lengths 350 ft.

(i) In territory where the temperature variation is more than 120 degrees F., compensation shall be provided for each pipe line as follows:

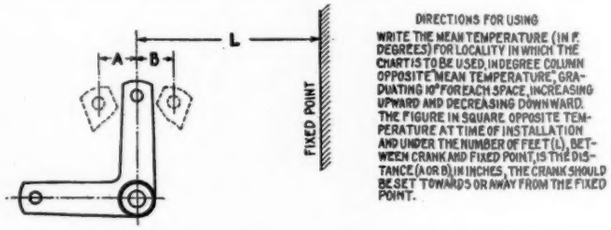
For 8¾-in. stroke, lengths 470 ft.

For 9¾-in. stroke, lengths 290 ft.

The committee recommended the approval of specification for universal compensation of pipe line and drawings 1536, 1537 and 1538 for presentation at the annual meeting.

Complete specifications for mechanical interlocking apparatus, a consummation of years of work on this subject, together with requisite sheets, were presented by the committee for approval for presentation at the annual meeting.

Committee: C. J. Kelloway (A. C. L.), chairman; W. N. Spangler (P. R. R.), vice-chairman; W. F. Zane (C. B. & Q.), vice-chairman; T. S. Adams (N. Y. C.), Larsen Brown (A. T. & S. F.), W. F. Cook (D. & H.), Oswald Frantzen (N. Y. N. H. & H.), Wm. Hiles (C. C. C. & St. L.), F. E. Jacobs (C. & W. I.), H. F. Lomas (I. C.), E. E. Mack (C. & E. I.), J. W. McClelland (P. & R.), W. B. Morrison (D. L. & W.), G. S. Pflasterer (N. C. & St. L.), E. J. Relph (N. P.), C. Smith (St. L.-S. F.), Chas.



F°	20'	40'	60'	80'	100'	120'	140'	160'	180'	200'	220'	240'	260'	280'	300'	L
°	1/8	5/16	1/2	5/8	13/16	15/16	1 1/8	1 1/4	1 7/16	1 5/8	1 3/4	1 15/16	2 1/16	2 1/4	2 3/8	A - AWAY FROM FIXED POINT
°	1/8	1/4	7/16	9/16	3/4	7/8	1	1 1/8	1 1/4	1 7/16	1 9/16	1 3/4	1 7/8	2	2 3/16	
°	1/8	1/4	3/8	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 7/16	1 9/16	1 11/16	1 13/16	1 15/16	
°	1/8	1/4	5/16	7/16	9/16	11/16	13/16	7/8	1	1 1/8	1 1/4	1 3/8	1 7/16	1 9/16	1 11/16	
°	1/8	3/16	5/16	3/8	1/2	9/16	11/16	3/4	7/8	1 15/16	1 1/16	1 1/8	1 1/4	1 3/8	1 7/16	
°	1/16	3/16	1/4	5/16	3/8	1/2	9/16	5/8	3/4	13/16	7/8	15/16	1 1/16	1 1/8	1 3/16	
°	1/16	1/8	3/16	1/4	5/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4	13/16	7/8	15/16	
°	1/16	1/8	1/8	3/16	1/4	5/16	5/16	3/8	7/16	1/2	1/2	9/16	5/8	11/16	3/4	
°	1/16	1/16	1/8	1/8	3/16	3/16	1/4	1/4	5/16	5/16	3/8	3/8	7/16	7/16	1/2	
°	1/16	1/16	1/16	1/16	1/16	1/8	1/8	1/8	1/8	3/16	3/16	3/16	3/16	1/4	1/4	
°	MEAN TEMPERATURE															
°	1/16	1/16	1/16	1/16	1/16	1/8	1/8	1/8	1/8	3/16	3/16	3/16	3/16	1/4	1/4	B - TOWARDS FIXED POINT
°	1/16	1/16	1/8	1/8	3/16	3/16	1/4	1/4	5/16	5/16	3/8	3/8	7/16	7/16	1/2	
°	1/16	1/8	1/8	3/16	1/4	5/16	5/16	3/8	7/16	1/2	1/2	9/16	5/8	11/16	3/4	
°	1/16	1/8	3/16	1/4	5/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4	13/16	7/8	15/16	
°	1/16	3/16	1/4	5/16	3/8	1/2	9/16	5/8	3/4	13/16	7/8	15/16	1 1/16	1 1/8	1 3/16	
°	1/8	3/16	5/16	3/8	1/2	9/16	11/16	3/4	7/8	1 15/16	1 1/16	1 1/8	1 1/4	1 3/8	1 7/16	
°	1/8	1/4	5/16	7/16	9/16	11/16	13/16	7/8	1	1 1/8	1 1/4	1 3/8	1 7/16	1 9/16	1 11/16	
°	1/8	1/4	3/8	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 7/16	1 9/16	1 11/16	1 13/16	1 15/16	
°	1/8	1/4	7/16	9/16	3/4	7/8	1	1 1/8	1 1/4	1 7/16	1 9/16	1 3/4	1 7/8	2	2 3/16	
°	1/8	5/16	1/2	5/8	13/16	15/16	1 1/8	1 1/4	1 7/16	1 5/8	1 3/4	1 15/16	2 1/16	2 1/4	2 3/8	

Table of Crank Adjustments With Temperature Changes

Stephens (C. & O.), M. E. Sutherland (Maine Cent.), R. W. Taylor (B. & O.), J. I. Vernon (N. Y. N. H. & H.), E. L. Waltz (C. G. W.).

Discussion

E. T. Ambach (B. & O.): The statement was made yesterday that there are no specifications for cement. The American Railway Engineering Association has a specification on cement and also on reinforced concrete.

The committee would do well to adopt something that some other section has, rather than to leave it open.

C. J. Kelloway (Chairman): The specification is very broad here, "Cement shall comply with specifications of the purchaser."

(A motion that the specifications for compensation of concrete trunking for presentation to the annual meeting was carried.)

Chairman Kelloway: The committee found that the clause for compensation was too voluminous to include in the major specification, and we have prepared a unit specification for compensation of pipe lines.

(A motion that the specifications for compensation of pipe line, and drawings 1536, 1537 *and* 1538, *be accepted for presentation to the annual meeting, was carried.)*

Chairman Kelloway: The specifications for mechanical interlockers were discussed at length at the last meeting of this association. Most suggestions made have been incorporated in the specifications. The committee desires to change the paragraph on painting to read: "All unfinished parts of interlocking machine above the floor, including the levers, shall be painted one coat of red lead and three linseed oil and two coats black."

(A motion to this effect was carried.)

(A motion to the effect that the specifications for mechanical interlockers be approved for presentation at the annual meeting, with requisite sheets, was carried.)

(The committee was excused with thanks of section.)

Reports of the Committee on Contracts

The table of recommended unit values for the division of expense of installation, maintenance and operation of joint interlocking plants as applied to mechanical plants varies but little from the table adopted by the association in 1907. It has been supplemented by a few additional items for mechanical plants and by values assigned for power operated units which are considered equitable. Any table of units will prove equitable for dividing the cost of ownership installation, operation and maintenance when applied fairly and the law of averages allowed to apply, although it is conceded that no table can be made entirely equitable.

George E. Beck
Chairman

George E. Beck has been chairman of this committee since it was organized two years ago, prior to which time he was chairman of the old R. S. A. Committee on Storage Batteries and Charging Equipment. He started as a blacksmith in the signal department of the Michigan Central in 1898 and three years later transferred to the Lake Shore & Michigan Southern. He was promoted to foreman in March, 1902, and was appointed assistant supervisor two years later, being promoted to signal supervisor in 1906 and in 1913 to chief signal inspector. He was appointed assistant signal engineer of valuation, N. Y. C., Lines West, in 1916.

THE COMMITTEE submitted a report, including a table of recommended unit values for the division of the expense of installation, maintenance and operation of joint interlocking plants.

In arriving at the following table it will be noted that the committee did not materially vary from the table of unit values adopted by the American Railway Engineering Association in 1907, as applied to mechanical plants.

The table has been supplemented by (a) a few additional items for mechanical plants and by (b) values assigned for power-operated units which are considered equitable either when used in a plant that is entirely power-operated or in combination.

The committee concedes that no table of units can be made which will be entirely equitable for dividing all the cost of ownership, installation, operation and maintenance, but experience has demonstrated that almost anv table of units will prove equitable when applied fairly and the law of averages allowed to apply.

The committee recommended that this table of interlocking units and values be accepted for approval for presentation at the annual meeting.

Committee: G. E. Beck (N. Y. C.), chairman; H. F. Haag (K. C. S.), vice-chairman; J. B. Latimer (C. B. & Q.), H. C. Lorenzen (P. M.), J. C. Mock (M. C.), J. A. Peabody (C. & N. W.), W. F. Seemuth (C. M. & St. P.).

Discussion

R. M. Phinney (C. & N. W.): The use of the indicator for a unit is not good because it is not positive to determine just how many indicators are going to be used in a plant of that kind. The use of the railroad indicator leaving out the relay discriminates against the use of indicator or indicating relay.

R. B. Arnold (C. & N. W.): Is it the intention of the committee to call a lock, an indicator or an annunciator, one unit each in the table of units? It is common practice to include the lever lock and indicator in

Table of Interlocking Units and Values

Unit No.	Unit	Description	Mechanically Operated Units	Power Operated Units
1	ea.	Fixed signal arm or light (or combined)	1	1
2	ea.	Non-operated signal complete (mast, blade or light)	2	2
3	ea.	Signal operated by switch or derail	1	1
4	ea.	Signal, 2-position	4	4
5	ea.	Signal, 3-position	8	8
6	ea.	Single switch (2 points) derail, or torpedo machine	4	8
7	ea.	Derail pipe connected to, and operated by switch	1	
8	ea.	Movable point frog (4 points)	8	12
9	ea.	Single slip end (2 points)	4	8
10	ea.	Double slip end (4 points)	8	12
11	ea.	55 ft. of detector bar (or fraction thereof) on plant	2	2
12 (a)	ea.	Facing point lock or drawbridge lock with lever connection	2	6
(b)	ea.	Each additional lock when operated with other unit	1	1
13 (a)	ea.	Drawbridge circuit controller or pipe coupler when operated separately	4	8
(b)	ea.	Each additional controller or coupler when operated with other unit	2	2
14	ea.	Complete track circuit	2	2
15	ea.	Lock, indicator, annunciator, slot	1	1
16	ea.	Electric lock for outlying switch controlled from tower	2	2

circuit with it, as one unit. Another question I would like to ask is why you have fixed a signal or a light as a single unit.

Chairman Mock: On No. 15 each of those named as lock, indicator and annunciator, is a unit. Each has the same value as No. 1, fixed arm or light, or combined.

E. J. Relph (N. P.): I would like to know what the difference between a fixed signal arm and a non-operated signal arm is; why a fixed signal arm should have the value of one and non-operated signal should have the value of two.

Chairman Mock: Because it is not necessary to put the post up for one of them; you just stick it on the post that is there, and on the other you have to have the post.

F. P. Patenall (B. & O.): I wonder if the committee had in mind the question of length of track circuit. It may be 400 ft. or it may be 4,000 ft. Under those conditions the rating certainly ought not to be the same.

Chairman Mock: At an interlocking plant with a track circuit 400 ft. long there are usually more insulated joints and complications than with the ordinary track circuit.

(*A motion to the effect that the table of interlocking units and values be accepted for presentation at the annual meeting was carried.*)

(The committee was dismissed with the thanks of the Signal section.)

National Railway Appliances Association Meeting

THE ANNUAL MEETING of the National Railway Appliances Association was held yesterday morning at 11 o'clock in the dining room of the Coliseum with a larger attendance than usual.

President George C. Isbester in his annual report said:

"This is our second day of the fourteenth annual exhibition, and when you consider the limited floor space available, it is gratifying indeed to know how many we have been able to accommodate with exhibit space. It is equally gratifying to note that after 13 years we have been able to replace our fences and railings with new ones this year. And let me say here that it has been a revelation to me to see what has been done in the decorations, preparation, furnishings, etc.

Secretary-Treasurer C. W. Kelly's report was brief and to the point. He said:

"You are aware that we are unable to give you any reliable figures as to the possible outcome of the receipts and expenditures of this exhibit at this time.

"I told you last year at this time that we stood to run short some $1,800 to $2,000, but after all expenditures were in and collections made we were able to report $114 profit.

"We will not do as well this year."

J. B. Strong, chairman of the nominating committee, reported the finding of the committee as follows:

"T. W. Aishton, of the National Malleable Castings Company, for President; L. W. Shugg, of the General Electric Company, Vice President; J. W. Gillingham, of the Hall Switch & Signal Company, as Director for three years; W. B. Murray, of the Miller Train Control Corporation, Director for three years; G. A. Johnson, of the Duff Manufacturing Co., for one year, to fill out the unexpired term of Mr. Shugg."

The secretary was instructed to cast the ballot of the entire membership present for the above named officers.

The actions of the Board of Directors for the past year

Inasmuch as there seemed to be a strong sentiment among the members that the annual meeting should be held hereafter on Monday morning, the opening day, instead of Tuesday morning, a resolution changing the date was accordingly passed.

T. W. AISHTON, PRESIDENT-ELECT

Thomas W. Aishton, the newly elected president, is a native of Iowa. His railroad experience has been in the maintenance of way and the operating departments of the Chicago & North Western railway. His activities on that road were on the Galena, Dakota, Minnesota and Iowa divisions. He rose through various trades in maintenance of way and operating departments to the position of train master, with headquarters at Clinton, Iowa. His activities in the selling field have been with the National Malleable Casting Company, with which he has been connected as sales agent for a number of years.

All in a Day's Work

THE VARIETY OF PROBLEMS which arise in the office of the secretary of a large association is indicated in the following letter which was received by E. H. Fritch recently:

По вх. №_____

ОБЩЕСТВО
Китайской Восточной
жел.дорогой.
УПРАВЛЕНІЕ ДОРОГИ.

Американскому О-ву Желѣзнодорожныхъ Инженеровъ
Чикаго, Иллінойсъ С.Ш.

18/IX 1921 г.
№ 15896.
г. Харбинъ.

Вх. №_____

Милостивые Государи.

Имѣю честь просить Васъ не отказать выслать одинъ изъ изготовляемыхъ Вашимъ Обществомъ приборовъ для измѣренія напряженія въ частяхъ мостовыхъ ферм "Экстенсометръ" на имя Начальника Службы Пути, Управленіе Китайской Восточной жел.дороги въ Харбинѣ.

Стоимость прибора въ 150 американскихъ долларовъ одновременно съ симъ переводимъ чекомъ на Ваше имя черезъ Китайско-Американскій Банкъ въ Харбинѣ.

Вр.Начальникъ Службы Пути и Сооруженій, Инженеръ

К. В. Стр. Сбщ. № 16%.

The translation of this letter from Russia indicates the extent of the influence of the Engineering Association.

Association of the Chinese Eastern Railroad
Management of Railway.

American Railway Engineering Association,
Chicago, Ill.

Gentlemen:—

I am taking the liberty of asking you to send one of your "Extensometers" for measuring the tension of pavements, to: Chief of the Management of the Chinese-Eastern Railway at Harbin.

The price of said apparatus, i. e. $150.00 we have forwarded to you simultaneously with this letter, through the Chinese-American Bank at Harbin.

Chief of Management and Construction
Engineer (signature illegible)

The Making of the Railway Age March Dailies

Prompted by Numerous Inquiries the Editors Relate How the Work Is Done from Beginning to End

ANOTHER YEAR HAS COME and with it the meetings of the American Railway Engineering Association and the Signal Section of the American Railway Association that bring you to Chicago. Perhaps as you sat down to your breakfast this morning you dwelt a little upon that thought. And as you turned it over in your mind while your fingers idly ruffled through the pages or marked a place where you had been reading in your copy of the Railway Age March Daily, another thought may have occurred to you. Whether your first Daily or, with the familiarity of an old member, your thirteenth Daily, your interest was aroused, maybe for only a moment, and you wondered how we did it, when and where. Regularly and unobtrusively, the Dailies, the largest issued by any publisher, have appeared at your hotel ready for you when you awoke to give you accurately and concisely the doings of the previous day's sessions and surrounding activities. To us familiar with the making of the Dailies, the complexities and details of publishing one every 24 hours, an issue of the size and character of the Railway Age March Daily, are still interesting. We think you will find them equally so.—(THE EDITORS.)

The heart of the convention is the Florentine Room and it is there that much of the real benefit of the meeting is obtained. Discussion, as we all know, is the quickest way of smoothing out differences of opinion and advancing the status of engineering. The man who could attend all the sessions, hear all the discussion of all the reports, select the wheat from the chaff, keep his head clear and unconfused, store away in his mind what he has learned, visit with acquaintances, inspect the exhibits and discuss the things which he has seen, is not nor cannot be. It is too much for the most ambitious of men. He can only choose what is closest to his interests. Hence the Dailies, where he may reveiw at his leisure moments during and after the sessions, the activities he was unable to take part in.

For weeks before the convention the work of organizing for the publication is carried on by the regular Railway Age staff and that staff alone carries it on through to the end. There is first among many things the reading and editing of the reports of the committees, the separating and condensing of data so that duplication may be avoided, retaining the heart of the report and yet keeping it all within the bounds of a paper that will be and can be read without taking too much of the valuable convention time. Illustrations for the reports must be prepared and portraits of the officers and others of the association must be secured, mounted, measured and photo-engravings made. Not one portrait can be dispensed with. The series must be complete.

From the experience gained in the past, it is possible to estimate the space required to cover the various activities which will take place during the convention. This estimate includes editorials, special articles, reports and discussions, news, articles about new devices and other miscellaneous matters and forms the nucleus around which the Dailies are built. While the reports are being edited and the photographs procured, arrangements are being made for the remainder of the editorial articles which can be prepared in advance. Heads are written for the reports and all material is sent to the printshop as soon as it is written. All of this done, the type must be measured for length, recorded and indexed, the proofs read, corrected and approved and everything put in readiness so that when wanted there will be no hitch to tangle up or slow down the work of publication when the real rush begins.

The things enumerated above are only the high points of the before-the-convention editorial work. From four to five editors are on this assignment regularly, yet it must not and does not interrupt or interfere with the regular publication work or the other papers of this company. Many a night sees the lights burning over editorial matter for the Dailies. It is not amiss to add here that the work, arrangements and schedules outlined above as well as those that will be mentioned later cover only the meetings of the American Railway Engineering Association. When the signal meetings are held, as they are this year and as they were two years ago, the work of preparation, not to speak of that of the actual publication, is increased twofold, yet the same staff handles both. Duties already double normal become quadrupled —still the Dailies appear.

In the meantime, arrangements are being made for the removal of the Railway Age staff from its regular offices to temporary offices in the hotel. Rooms must be acquired, furniture moved and procured, and living quarters assigned, for our editors must live at the hotel during the convention. Time is precious. Minutes, not hours, are the divisions. Printshop facilities, engravings, messenger, taxi, phone and telegraph service are arranged for, keyed up to the requisite speed and scheduled. Court reporters familiar with the convention work are secured. With all these thousand and one details, large and small, of which we have only suggested the high spots here, finished, the opening day of the signal meeting—one day previous to the A. R. E. A. convention—has arrived. One final conference of the staff is held, at which all of the details are checked carefully, assignments rehearsed, and then the real work starts.

The problem is to present the real meat of the discussion verbatim—not some one editor's impressions of what some member may have said, and again, as with the reports, to keep them within the bounds of a readable paper. Close up to the officers' table, the court reporter sits, taking down word for word what each member says. The senior member of the reportorial staff that takes down your words has seen each March Daily come and go since their inception. He knows most of the members by name and by road and, unless we are badly mistaken, we believe that in many cases he often knows what some are going to say before they have said it. At intervals each reporter is relieved by another, the break being made after short periods of time in order to speed up the transcription. The discussion already taken down in shorthand is then dictated to an experienced typist, who has also seen many an A. R. E. A. convention come and go. From the beginning of the morning session to well after the end of the afternoon session, this typist transcribes rapidly and steadily the words used but a few minutes before on the floor of the convention. Two copies are made and as soon as each sheet is completed, one copy is sent immediately to a nearby room where two editors are stationed in readiness, with everything necessary for the efficient, accurate and speedy editing of the discussion or "running

report," as it is called. This includes among many things, copies of the original reports, galley proofs of the reports as edited, estimates of space, pencils, ruler, scissors, paste pots, blank paper. Virtually if not actually, for quiet and freedom from interruption are paramount, these editors are locked in their room.

As each sheet of the discussion is received, it is read carefully, its importance weighed carefully, names, figures, words and expressions corrected where wrong, condensed where possible by judicious cutting, then check-read, numbered, stamped with the report number according to our print shop and copy list schedule, approved and sent on its way. The next stop is the desk of the editor in charge of the Dailies who, closely familiar with the work of the convention, passes upon it to see that everything has been covered properly, that it has not been edited too closely or too loosely and that it is free from mistakes. An estimate is made of the length of the discussion of each report and its identification marks are re-checked to prevent any possible confusion. It is then dispatched by special messenger service to the printshop where the linotype operators seize upon it and quickly convert it into slugs of type. Galley proofs are struck off, submitted to the editorial make-up man and his assistant, both of whom are editors familiar with all phases of the publishing work and stationed at the printshop. They read, correct, measure and schedule them. This transposition of words to type actually takes only a short time, so smoothly and speedily does this system work.

While this work of editing the running report of the session is on, other editors are busy mixing with the members, sitting in the session, making notes on important points for editorial comment, studying the exhibits and otherwise doing the hundred and one little things that go to the securing and publishing of the up-to-the-minute news of the convention. Lines, paragraphs, articles, even photographs and whatnot from various sources and directions are correlated, passed upon, and dispatched to the lineotype machines—all through one central "clearing house." At the registration desk two members of the staff aid in the registration of the members attending each session. At intervals during the day duplicate lists of the registrations are made up and sent to the editor in charge. These lists are checked against the membership list of the association and other data to insure accuracy, after which one copy is forwarded to the printshop. Each succeeding list is handled likewise, the names being arranged alphabetically after being set up in type. The duplicate list or lists are retained by the member of the staff who is in charge of the delivery of the Dailies. He arranges the names, not according to the letter of the alphabet, but according to the hotel addresses and room numbers of the members, and from this he is able to make his plans for the delivery of the copies.

By early afternoon, it is possible for the editor in charge, working with the editors in the printshop, to obtain a fairly accurate estimate of the amount of printed matter, better known as "copy," which will appear the next morning. Space is then allotted by pages to the various sections of the paper, after which the mechanical make-up is started—usually this is late in the afternoon. Contrary to what may be considered by the layman as the way it is done,—the type is assembled or, in the vernacular, the paper is made up, by sections, starting at the first or editorial page, at the beginning of the convention sessions and at the last page. The first two sections are made up, working toward the back of the paper while the third is worked forward. The closing of the paper is, of course, delayed until the last copy has come through and has been set up in type, but in the meantime, three-fourths or more of the paper has been put in page form, proofs have been taken, read and corrected for size of type, spacing, headings and typographical errors.

As soon as each page is made up it is placed in the forms, where it remains until all the spaces in the 4, 8 or 16-page forms, depending upon the number of pages in the paper, have been filled and the pages finally passed and approved. The forms are then locked and sent to the press room. Ordinarily this work, as outlined, is completed and the forms released by midnight or a little after, the scheduling calling for the press to be started on the last four by 2 o'clock in the morning at the latest. In order to catch any possible errors, one or more of the editors closely familiar with the sessions of the day and the editing of the running report go to the printshop in the evening after their other work has been completed to remain until the forms go on the press.

When photographs are taken of the convention in session added complications arise. Detailed arrangements are made beforehand for the photographer to take his picture with the minimum interruption to the meeting. The engraver is waiting for the photograph to be taken and accompanies the camera operator to his studio, where the plate is developed, a print made, and blotted to hasten its drying. He then takes it to his engraving shop by taxicab, where special men are retained to perform all of the complicated operations entering into the making of a half-tone. These operations being completed, in turn, the copper engraving is dispatched, again by messenger, to the printshop, where it is inserted into a space carefully measured beforehand and left for it and the forms are sent to the press.

The paper, as it leaves the press, is seized by the binders, still wet from the printing, who fold, bind, trim and handle it in quantities of 100 copies. This, as you may well surmise, happens along near the time when the sun is beginning to appear. Each lot of 100 copies is then loaded into taxicabs and accompanied by members of the Railway Age staff, delivery is begun. Time is still precious, for a copy must be addressed for each member attending the meeting and it must be delivered at the door of his room before the time he has decided to arise in the morning. Not only that but all of the regular subscribers of the Railway Age located in the downtown district of the city must also receive their copies by special messenger. In the meantime other copies are bound and taken to the postoffice for mailing to the subscribers to the Railway Age. By eight o'clock at the latest, and usually much before that, delivery is completed and another March Daily is out. Thus, the Railway Age March Dailies, no longer an innovation in magazine publishing but an institution, combining newspaper promptness and activity with magazine size, thoroughness and accuracy, are brought before you each morning.

First Railway Station at Anchorage, Alaska

American Railway Engineering Association Registration

THE REGISTRATION OF MEMBERS and guests of the American Railway Engineering Association yesterday totaled 666. This is the highest first day's registration in the history of the association, comparing with 593 last year and 534 in 1920. The crowded condition of the convention room and the numerous complaints from members who were unable to secure seats reflected this condition.

The registration follows:

Abbott, F. E., insp. engr., Lackawanna Steel Co., Buffalo, N. Y.
Abbott, R. B., asst. gen. supt., P. & R., Reading, Pa.
Ackerman, F. J., sig. engr., K. C. Term., Kansas City, Mo.
Albright, C. C., assoc. prof. ry. eng., Purdue Univ., Lafayette, Ind.
Allen, L. B., engr. m. of w., C. & O., Huntington, W. Va.
Allen, L. J., chf. engr., A. A., Owosso, Mich.
Ambrose, J. R. W., chf. engr., Tor. Term., Toronto, Ont.
Ames, Azel, Kerite Insulated Wire & Cable Co., New York.
Amoss, F. X., Winnipeg, Man.
Anderson, Irving, div. engr., A. T. & S. F., Marceline, Mo.
Angerer, Victor, vice-pres., William Wharton, Jr. & Co., Easton, Pa.
Angier, F. J., supt. timber pres., B. & O., Baltimore, Md.
Armour, Robert, mas. engr., G. T., Montreal, Can.
Armstrong, J. E., asst. engr., Can. Pac., Montreal, Can.
Armstrong, W. R., asst. chf. engr., O. S. L., Salt Lake City, Utah
Arn, W. G., asst. engr. m. of w., I. C., Chicago.
Atwill, A. Lee, asst. engr., C. G. W., Chicago.
Atwood, Col. Wm. G., National Research Council, New York.
Austill, H., bridge engr., M. & O., St. Louis, Mo.
Aylsworth, R. G., asst. engr., C. B. & Q., Denver, Colo.
Backes, W. J., engr. m. of w., N. Y. N. H. & H., New Haven, Conn.
Backus, M. M., dist. engr., I. C., Waterloo, Ia.
Badger, O. C., asst. engr., A. T. & S. F., Chicago.
Baird, R. C., asst. engr., C. R. I. & P., Chicago.
Baisinger, W. C., rdmaster, A. T. & S. F., Ottawa, Kansas.
Baker, J. B., engr. m. of w., Penna., Cleveland, Ohio.
Bakhshi, S. R., asst. chf. draftsman, C. B. & B., Chicago.
Baldridge, C. W., asst. engr., A. T. & S. F., Chicago.
Baldwin, A. S., vice-pres., I. C., Chicago.
Baldwin, R. A., dist. engr., Can. Nat., Toronto, Ont.
Baluss, F. C., engr. b. & b., D. M. & N., Duluth, Minn.
Banks, T. G., dist. engr., M. K. & T., Oklahoma City, Okla.
Bardwell, R. C., engr. water serv., Mo. Pac., St. Louis, Mo.
Barrett, J. E., supt. b. & b., L. & H. R., Warwick, N. Y.
Barrett, W. C., trnmstr., L. V. R., Sayre, Pa.
Bartlett, Calvin, sup. land apprs., Wabash, St. Louis, Mo.
Batchelder, F. L., chf. engr., Cop. Range, Houghton, Mich.
Bates, F. E., asst. bridge engr., Mo. Pac., St. Louis, Mo.
Bathellor, F. D., div. engr., B. & O., Garrett, Ind.
Bates, Onward, cons. engr., Chicago.
Beach, Dr. S. C., health officer, I. C., Chicago.
Beckett, F. T., engr. m. of. w., C. R. I. & P., El Reno, Okla.
Belcher, R. S., manager treating plants, A. T. & S. F., Topeka, Kansas.
Bell, Gilbert J., dist. engr., A. T. & S. F., Topeka, Kansas.
Bell, H. C., supt. tie treating plant, N. & W., East Radford, Va.
Benjamin, H. I., office engr., Sou. Pac., San Francisco, Cal.
Bennett, Edgar, asst. engr., Southern, Chattanooga, Tenn.
Bennett, V. A., asst. engr., Nor. Pac., Fargo, N. D.
Bernhardt, J. E., brdg. engr., C. & E. I., Chicago.
Blackie, G. F., asst. chf. engr., N. C. & St. L., Nashville, Tenn.
Blaess, A. F., engr. m. of w., I. C., Chicago.
Blaiklock, M. S., engr. m. of w., G. T., Montreal, Can.
Blanchard, A. M., pilot engr., G. T., Montreal, Can.
Bloecher, Theo., Jr., div. engr., B. & O., Baltimore, Md.
Blum, Bernard, engr. m. of w., Nor. Pac., St. Paul, Minn.
Boardman, Francis, div. engr., elec. div., N. Y. C., New York.
Boardman, H. E., engr. asst to gen. val. coun., N. Y. C., New York.
Bohland, J. A., bridge engr., G. N., St. Paul, Minn.
Bond, L. H., dist. engr., I. C., Chicago.
Boyce, W. S., west mgr., Lundie Engineering Corp., Chicago.
Boyd, G. E., Roseville, Ill.
Bradley, A. C., div. engr., C. R. I. & P., Chicago.
Brameld, W. H., eng. asst. to gen. mgr., Erie, New York.
Breckinridge, W. L., asst. chief engr., C. B. & Q., Chicago.
Breed, Chas. W., office engr., C. B. & Q., Chicago.
Breen, J. E., office engr., Long Island, Richmond Hill, N. Y.
Bremner, Geo. H., consult. engr., Chicago.
Brewer, H. H., asst. gen. mgr., Can. Nat., Winnipeg, Man.
Brown, A. V., engr. m. of w., Lake Shore Elec., Sandusky, Ohio.
Brown, C. W., supt., L. & N. E., South Bethlehem, Pa.
Brown, E. H., supr., B. & B., Nor. Pac., Minneapolis, Minn.
Brown, G. H., asst. chief engr., m. of w., Penna., Philadelphia, Pa.
Brown, H. C., Jr., Chicago Bridge & Iron Works, New York.
Brown, H. W., div. engr., Penna., Zanesville, Ohio.
Brown, J. M., corp. engr., maint. & conts., C. R. I. & P., Chicago.
Browne, H. L., res. engr., C. B. & Q., Pineville, Ky.
Brumley, D. J., chief engr., Chicago term. imp., I. C., Chicago.
Brunner, John, asst. insp. engr., Illinois Steel Company, Chicago.
Burnett, W. S., engr. m. of w., C. C. C. & St. L., Springfield, Ohio.
Burrage, W. H., pilot, val. dept., N. Y. C. & St. L., East Cleveland, Ohio.
Burrell, Chas. F., engr., m. of w., K. & I. Term., Louisville, Ky.
Burton, W. J., asst. val. engr., Mo. Pac., St. Louis, Mo.
Busch, Harry F., div. engr., St. L.-S. F., Fort Scott, Kan.
Butterworth, A. S., chief engr., G. F. & A., Pensacola, Fla.
Byram, C. R., asst. engr. rdway., I. & G. N., Palestine, Tex.
Camp, W. M., editor, Railway Review, Chicago.
Campbell, H. A., Chicago.
Campbell, J. L., chf. engr., E. P. & S. W., El Paso, Tex.
Carmichael, J., W. M., Hagerstown, Md.
Carothers, J. B., asst. to gen. mgr., B. & O., Cincinnati, Ohio.
Carroll, G. A., div. engr., C. R. I. & P., Kansas City, Mo.
Cassil, H. A., engr. m. of w., Pere Mar., Detroit, Mich.
Chase, J. A., asst. engr., B. & A., Boston, Mass.
Cheney, B. M., gen. inspr. perm. way, C. B. & Q., Chicago.
Chevalier, C. R., rdmster., Port. Term., Portland, Me.
Chinn, Armstrong, instrumentman, eng. dept., C. B. & Q., Chicago.
Christian, W. A., cons. engr., City of Chicago, Chicago.
Christiansen, Eli., asst. engr. bldgs., C. R. I. & P., Chicago.
Churchill, Chas. S., vice-pres., N. & W., Roanoke, Va.
Clapper, Leland, engr. b. & b., D. & I., Two Harbors, Minn.
Clark, W. A., chief engr., D. & I. R., Duluth, Minn.
Clarke, A. C., dist. engr., B. & O., Pittsburgh, Pa.
Clarke, H. S., engr. m. of w., D. & H., Albany, N. Y.
Clarke, R. N., asst. engr., Mo. Pac., Kansas City, Mo.
Clements, M. F., bridge engr., Nor. Pac., St. Paul, Minn.
Cleveland, G. C., chf. engr., N. Y. C., Cleveland, Ohio.
Coburn, Maurice, engr. m. of w., Penna., Indianapolis, Ind.
Colladay, W. E., asst. engr., I. C., Chicago.
Connor, E. H., chief engr. Missouri Valley Bridge & Iron Co., Leavenworth, Kan.
Conway, T. H., asst. engr., Nor. Pac., Livingston, Mont.
Cook, C. C., maint. engr. (corp.), B. & O., Baltimore, Md.
Cook, O. U., insp. engr., Tennessee Coal, Iron & Railroad, Birmingham, Ala.
Cook, R. L., office engr., Cent. of Ga., Savannah, Ga.
Coon, C. J., engr., Grand Central Term., N. Y. C., New York.
Cooper, S. D., asst. mgr. treating plants, A. T. & S. F., Topeka, Kan.
Courtenay, W. H., chf. engr., L. & N., Louisville, Ky.
Craine, Arthur, dist. engr. m. of w., C. B. & Q., St. Louis, Mo.
Crane, E. B., engr.-audi., C. M. & St. P., Chicago.
Crites, G. S., div. engr., m. of w., B. & O., Baltimore, Md.
Crumpton, Arthur, val. engr., G. T., Montreal, Can.
Cummins, R. R., rdmster, Cent. of G., Macon, Ga.
Cunningham, C. C., div. engr., C. R. I. & P., Herington, Kans.
Curd, W. C., consult. engr., Chicago.
Curtis, L. B., asst. engr., Nor. Pac., St. Paul, Minn.
Cushing, W. C., engr. of stand., Penn., Philadelphia, Pa.
Dale, L. E., sup., Penn., Philadelphia, Pa.
Daley, C. A., office engr., Erie, Hornell, N. Y.
Dalstrom, O. F., engr. of bridges, C. & N., Chicago.
Dare, C. E., res. engr., R. F. & P., Alexandria, Va.
Davidson, Geo., M., ind. engr., C. & N. W., Chicago.
Davidson, J. H., water engr., M. K. & T., Dallas, Tex.
Davis, A. L., prin. asst. engr., I. C., Chicago.
Deckert, J. E., chf. draftsman, val. dept., C. B. & Q., Chicago.
Delo, C. G., chf. engr., Chi. Gt. W., Chicago.
Dennis, W. O., sup., L. & N. E., Pen Argyle, Pa.
Dorsey, J. C., div. engr., D. & H., Albany, N. Y.
Dodgson, F. L., cons. engr., General Railway Signal Co., Rochester, N. Y.
Donahey, J. A., Cleveland, O.
Dorrance, W. T., des. engr., N. Y. N. H. & H., New Haven, Conn.
Dorsey, J. C., div. engr., D. & H., Albany, N. Y.
Douglas, H. T., Jr., chf. engr., C. & A., Chicago.
Downs, J. L., rdmster, I. C., Champaign, Ill.
Downs, L. A., vice-pres. & gen. mgr., Cent. of Ga., Savannah, Ga.
Doyle, T. L., asst. div. engr., Penna., Grand Rapids, Mich.
Dufour, F. O., prof. civ. engr. & dir. mat. test. lab., Lafayette College, Easton, Pa.
Dugan, G. H., engr. m. of w., D. & W., Washington, D. C.
Duncan, K. B., dist. engr., G. C. & S. F., Galveston, Texas.
Dyke, R. L., div. engr., Erie, Hornell, N. Y.

Eck, W. J., sig. and elec. supt., Southern, Washington, D. C.
Edgerton, H. H., engr. surveys, C. G. W., Chicago.
Edwards, W. H., pilot engr., val. dept., B. & O., Baltimore, Md.
Edwards, W. R., Baltimore, Md.
Eiker, W. H., dist. engr., C. B. & Q., Lincoln, Neb.
Elder, J. D., div. engr., Mich. Cent., Niles, Mich.
Elliott, W. H., sig. engr., N. Y. C., New York.
Ellis, C. A., vice-pres., Strauss Bascule Bridge Co., Chicago.
Ellis, G. E., sec., Automatic Train Control Committee, Chicago.
Ellis, J. A., asst. engr. stand., Can. Nat., Toronto, Can.
Ellis, P. O., acct. engr., M. K. & T., St. Louis, Mo.
Ellsworth, F. H., div. engr., N. Y. N. H. & H., Hartford, Conn.
Eutwistle, E. B., chf. engr., J. & S. C., Johnstown, Pa.
Evans, John, div. engr., Mich. Cent., Detroit, Mich.
Evans, W. T., asst. engr., C. & A., Chicago.
Everham, A. C., west. cont. mgr., Raymond Concrete Pile Co., Kansas City, Mo.
Fairchild, Dennison, sup. b. & b., Nor. Pac., Duluth, Minn.
Farlow, G. B., asst. engr., B. & O., Cincinnati, O.
Faucette, W. D., chf. engr., S. A. L., Norfolk, Va.
Felt, C. F. W., chf. engr., system, A. T. & S. F., Chicago.
Fenstermaker, D. C., prin. asst. engr., C. M. & St. P., Chicago.
Fickes, C. R., engr., United States Railroad Administration, Chicago.
Filippi, Hugo, asst. engr., Chi. term. imp., I. C., Chicago.
Fisher, S. B., consult. engr., M. K. & T., Parsons, Kansas.
Fitzpatrick, P. D., chf. engr., Cent. of Vt., St. Albans, Vt.
Foley, John, forester, Penn., Philadelphia, Pa.
Ford, C. F., supvr. tie and timber dept., C. R. I. & P., Chicago.
Ford, R. H., asst. chief engr., C. R. I. & P., Chicago.
Freeman, J. E., mgr. struc. bureau, Portland Cement Association, Chicago.
Frink, E. A., prin. asst. engr., S. A. L., Norfolk, Va.
Fritch, E. H., Chicago.
Fulks, E. B., Arkansas Preservative Co., St. Louis, Mo.
Fulweiler, W. H., cons. chem., United Gas Improvement Co., Philadelphia, Pa.
Funda, F. P., asst. div. engr., C. R. I. & P., Little Rock, Ark.
Fuzine, Jukichi, ch. engr., So. Manchuria, Dairen, Manchuria, China.
Gagel, Edward, chief engr., N. Y. N. H. & H., New Haven, Conn.
Galbreath, A. W., val. engr., M. K. & T., Parsons, Kan.
Gaut, J. B., supt. b. & b., G. T., Chicago.
Gennett, C. W., Jr., Robt. W. Hunt & Co., Chicago.
Gilbert, G. H., engr. b. & b., Southern, Cincinnati, Ohio.
Godlove, Geo. W., Jr., office engr., A. T. & S. F., Marceline, Mo.
Going, A. S., engr. const. G. T., Montreal, Canada.
Goldstraw, Walter, asst. arch., G. T., Montreal, Canada.
Goos, J. H., insp. engr., G. N. St. Paul, Minn.
Grandy, A. L., ch. engr., P. M., Detroit, Mich.
Grant, E. W., asst. engr. val., A. T. & S. F., Topeka, Kan.
Grear, S. F., asst. engr., I. C., Chicago.
Griffin, A. M., arch., A. C. L., Wilmington, N. C.
Griggs, A. B., val. engr., A. T. & S. F., Topeka, Kan.
Grime, E. M., supr. b. & b., Nor. Pac., Fargo, N. D.
Guy, Frank L., res. engr., E. P. & S. W., Douglas, Ariz.
Haas, E. M., Simmen Automatic Railway Signal Co., Cleveland, Ohio.
Hadwen, T. L. D., asst. engr., C. M. & St. P., Chicago.
Haggander, G. A., bridge engr., C. B. & Q., Chicago.
Haines, W. L. R., asst. engr., Penna. Pittsburgh, Pa.
Hall, F. D., elec. engr., B. & M., Somerville, Mass.
Hamilton, G. F., dist. engr., C. B. & Q., Alliance, Neb.
Hamilton, H. F., dist. engr., G. N., St. Paul, Minn.
Hamilton, Paul, engr. t. & r., C. C. C. & St. L., Cincinnati, Ohio.
Hammond, A. J., asst. ch. engr., Chicago Union Station Co., Chicago.
Hand, G. F., gen. asst. engr., N. Y. N. H. & H., New Haven, Conn.
Hand, G. W., asst. to pres., C. & N. W., Chicago.
Harding, C. R., asst. cons. engr., Sou. Pac., New York City.
Harrington, C. J., rdmster., Y. & M. V., Memphis, Tenn.
Harris, G. H., asst. chief engr., M. C., Detroit, Mich.
Harris, W. J., div. engr., C. B. & Q., La Crosse, Wis.
Harsh, H. H., div. engr., B. & O., Pittsburgh, Pa.
Harte, C. R., const. engr., Connecticut Co., New Haven, Conn.
Hartley, L. C., chief engr., C. & E. I., Chicago.
Harvey, A. E., chief engr., Metropolitan St. Ry. Co., Kansas City, Mo.
Harvey, W. C., val. engr., C. G. W., Chicago.
Haugh, J. L., asst. to pres., U. P., Omaha, Neb.
Hawk, A. T., engr. bldgs., C. R. I. & P., Chicago.
Hawley, W. E., asst. engr., D. M. & N., Duluth, Minn.
Hayes, H. C., asst. engr., I. C., Champaign, Ill.
Hayes, V. R., supvr. track, Wabash, Forrest, Ill.
Hazen, H. T., acting. ch. engr., Can. Nat., Toronto, Ont.
Hegel, G. W., ch. engr., C. J., Chicago.
Heidenthal, W. C., engr. m. of w., N. Y. O. & W., Middletown, N. Y.
Hench, N. M., engr. track appl., Carnegie Steel Co., Pittsburgh, Pa.
Hendricks, V. K., Terre Haute, Ind.
Henning, C. S., const. engr., E. P. & S. W., El Paso, Tex.
Hewes, C. A., Kansas City., Mo.
Hewes, John, Jr., div. engr. B. & O., Flora, Ill.
Hewson, E. G., div. engr., G. T., Toronto, Ont.
Hill. W. A., spec. engr., C. B. & Q., Chicago.
Hillegass, E. B., m. of w., A. C. L., Savannah, Ga.
Hillman, A. B., asst. engr., Belt, Chicago.
Hinman, Dean, asst. engr., C. G. W., Chicago.
Hobbs, W. H., asst. engr., M. P., St. Louis, Mo.
Hockman, asst. engr., T. St. L. & W., Frankfort, Ind.
Holtsbery, E. A., div. engr., T. & O., Columbus, Ohio.
Hood, J. M., supt., A. C. & Y., Akron, Ohio.
Horth, A. J., Jr., div. engr., Erie, Youngstown, Ohio.
Hotchkiss, L. J., dis. engr., Foundation, Company, Chicago.
Houston, W. O., div. engr., M. C., Jackson, Mich.
Howson, E. T., western editor, Railway Age, Chicago.
Hoyt, W. H., chf. engr., D. M. & N., Duluth, Minn.
Hughes, L. J. F., insp. m. of w. & struct., C. R. I. & P., Chicago.
Hunley, J. B., engr. bridges & struct., C. C. C. & St. L., Cincinnati, Ohio.
Huntsman, F. C., asst. engr., Wabash, Springfield, Ill.
Hurd, G. R., supr. fire protec., I. C., Chicago.
Ilsley, A. B., engr. bridges, Southern, Charlotte, N. C.
Irving, T. T., chf. engr., G. T., Detroit, Mich.
Isaacs, John D., cons. engr., S. P., New York.
Jaekle, W. M., asst. engr. m. of w. & struct., S. P., San Francisco, Cal.
Jackson, C. T., dist. engr., C. M. & St. P., Chicago.
Johns, C. W., engr. of const., C. & O., Richmond, Va.
Johnson, A. A., U. S. Railroad Administration, Chicago.
Johnson, E. A., supt. b. & b., Maine Cent., Portland, Maine.
Johnson, E. N., track engr., Union depot, Can. Nat., Winnipeg, Man.
Johnson, Maro, asst. engr., I. C., Chicago.
Johnston, C. E., gen. mgr., K. C. Sou., Kansas City, Mo.
Johnston, E. T., asst. chf. drftman., Erie, New York.
Johnston, J. V., div. engr., M. & O., Murphysboro, Ill.
Johntz, H. H., engr. m. of w., M. K. & T., Parsons, Kan.
Jones, F. A., asst. sup. b. & b., B. & A., Springfield, Mass.
Jordan, S. A., engr. m. of w., B. & O., Cincinnati, O.
Kenly, R. G., asst. pres. & chf. engr., M. & St. L., Minneapolis, Minn.
Keig, J. R., gen. tie and timber insp., A. T. & S. F., Chicago.
Keough, R. E., asst. engr. of W., Can. Pac., Montreal, Canada.
Ketchum, M. S., prof. c. e., University of Pennsylvania, Philadelphia.
Kelly, W. W., engr. grand div., A. T. & S. F., Los Angeles, Cal.
Kenney, E. F., metallurgical engr., Midvale Steel & Ordnance Co., Philadelphia, Pa.
Kent, A. S., chf. engr., C. I. & L., Chicago.
Khuen, Richard, gen. mgr. of erec., American Bridge Co., Pittsburgh, Pa.
Kimball, E. E., ry. and trac. eng. dept., General Electric Co., Schenectady, N. Y.
Kimble, W. P., div. engr., Erie, Galion, Ohio.
King, E. E., prof. of ry. civil engr., University of Illinois, Urbana, Ill.
Kircher, Paul, Chicago.
Knight, H., reg. engr., Erie, Youngstown, Ohio.
Knowles, A. M., asst. engr. struct., Erie, New York.
Knowles, C. R., supt. water serv., Ill. Cent., Chicago.
Korsell, A. E., asst. engr., C. R. I. & P., Chicago.
Koyl, C. H., engr., water serv., C. M. & St. P., Chicago.
Kuehn, A. L., pres., American Creosoting Co., Louisville, Ky.
Kulp, B. R., div. engr., C. & N., Madison, Wis.
Kultchur, E. F., dist. engr., C. B. & Q., Galseburg, Ill.
LaBach, Paul M., engr. water serv., C. R. I. & P., Chicago.
Lacher, W. S., asst. eng. editor, Railway Age, Chicago.
Laird, H. G., engr. m. of w., A. C. L., Jacksonville, Fla.
Lakin, F. D., div. engr., Erie, Meadville, Pa.
Lane, E. G., engr. M. of W., B. & O., Baltimore, Md.
Lang, P. G., Jr., engr. bridges, B. & O., Baltimore, Md.
Larsson, G. G. E., asst. chf. engr., American Bridge Co., New York.
Laying, F. R., engr. track, B. & L. E., Greenville, Pa.
LeBoutillier, Geo., gen. supt., Penna., Harrisburg, Pa.
Lee, E. H., vice-pres., C. & W. I., Chicago.
Leeds, R. M., rdmster., L. & N., Louisville, Ky.
Lees, Thos., engr. water serv., Can. Pac., Winnipeg, Man.
Leffler, B. R., engr. bridges, N. C. Y., Cleveland, Ohio.
Leonard, W. B., D. & H.
Lewis, E. R., office engr., M. C., Detroit, Mich.
Lienhard, L. V., chf. drftman., A. T. & S. F., Amarillo, Tex.
Lindsay, C. E., spec. engr., N. Y. C., New York.
Little, J. G., spec. rep., Railway Age., New York.

Lloyd, H. A., maint. insp., Erie, New York.
Lonnbladh, L. F., consult. engr., La Ceiba., Honduras, C. A.
Loweth, C. F., chf. engr., C. M. & St. P., Chicago.
Lowther, W. H., div. engr., Un. Pac., Denver, Colo.
Lull, H. M., chf. engr., Sou. Pac., Houston, Tex.
MacFarland, H. B., Chicago.
MacLaren, G. P., engr. of m. of w., Can. Nat., Toronto, Ont.
Mack, W. C., chf. drftman., C. R. I. & P., Chicago.
Maddock, J. B., engr. bridges and buildgs., Cen. of Ga., Savannah, Ga.
Maischaider, A. F., engr. m. of w., C. C. C. & St. L., Mattoon, Ill.
Mann, B. H., sig. engr., Mo. Pac., St. Louis, Mo.
Manson, E. F., asst. engr., C. R. I. & P., Chicago.
Martius, F. T., Chicago.
Masters, F. H., asst. chf. engr., E. J. & E., Joliet, Ill.
McBride, J. S., engr. val., C. & E. I., Chicago.
McClanahan, S. L., div. engr., C. R. I. & P., El Reno, Okla.
McComb, R. J., Q. & C. Co., Chicago.
McCooe, David., supt. of track, G. T., Toronto, Ont.
McDade, W. F., div. engr., G. M. & Nor., Laurel, Miss.
McDonald, Hunter, chf. engr., N. C. & St. L., Nashville, Tenn.
McFadden, J. H., div. engr., Mo. Pac., Atchison, Kans.
McLeod, H. W., asst. engr., Can. Pac., Winnipeg, Mann.
McNab, William. chrmn., val. com., G. T., Montreal, Canada.
McVay, C. M., div. engr., K. & M., Charleston, W. Va.
Meigs, M. C., asst. engr., Y. & M. V., Memphis, Tenn.
Melton, J. K., official photographer, I. C., Chicago.
Merritt, F., chf. engr., G. C. & S. F., Galveston, Tex.
Metcalf, E. W., loc. engr., M. K. & T., St. Louis, Mo.
Metcalf, J. M., prin. asst. engr., M. K. & T., St. Louis, Mo.
Michel, Wm., ch. engr., H. V., Columbus, Ohio.
Middleton, R. J., asst. chf. engr., C. M. & St. P., Seattle, Wash.
Miller, C. F., div. engr., L. A. & S. L., Los Angeles, Cal.
Miller, J. L., engr. bridges, N. Y. C., Yonkers, N. Y.
Mock, J. C., sig. elec. engr., M. C., Detroit, Mich.
Montzheimer, A., chf. engr., E. J. & E., Joliet, Ill.
Moore, Milburn, eastern engr. editor, Railway Age, New York.
Moore, S. B., spec. engr., Sou. Pac., La Porte, Texas.
Morphy, L. G., chf. engr., Rutland, Rutland, Vt.
Morrison, W. W., chf. engr., P. S. & N., Brownsville, Pa.
Morrow, F. E., asst. chf. engr., C. & W. I., Chicago.
Morse, C. A., chf. engr., C. R. I. & P., Chicago.
Motley, P. B., engr. bridges, Can. Pac., Montreal, Canada.
Mottier, C. H., office engr., I. C., Chicago.
Mountain, G. A., chf. engr., Canadian Railway Commission, Ottawa, Canada.
Moursund, E. M., dist. engr., M. K. & T., Dallas, Tex.
Myers, J. B., engr., r. & t., B. & O., Baltimore, Md.
Nelson, N. P., div. engr., C. B. & Q., Casper, Wyo.
Neubert, John V., engr. m. of w., N. Y. C., New York.
Newbegin, P. C., maint. engr., B. & A., Houlton, Maine.
Newton, A. W., ch. engr., C. B. & Q., Chicago.
Nicholson, F. L., chf. engr., N. S., Norfolk, Va.
Niehaus, C. B., val. engr., Cent. of Ga., Savannah, Ga.
Norris, W. H., bridge engr., Me. Cent., Portland, Maine.
Nuelle, J. H., gen. mgr., N. Y. O. & W., Middletown, N. Y.
O'Donnell, J. E., asst. engr., Cent. Ver., St. Albans, Vt.
O'Rourke, G. M., rdmstr., I. C., Mattoon, Ill.
Olson, E. H., asst. engr., A. T. & S. F, Chicago
Palmer, G. P., engr. maint. & const., B. & O. C. T., Chicago.
Parker, W. A., asst. engr. m. of w., Un. Pac., Omaha, Neb.
Patenall, F. P., sig. engr., B. & O., Baltimore, Md.
Patterson, F. M., Chicago.
Patterson, J. C., reg. engr., Erie, Jersey City, N. J.
Patterson, R. E., div. engr., L. V., Hazelton, Pa.
Peabody, G. A., ch. engr., Cleveland Frog & Crossing Co., Cleveland, Ohio.
Pearson, R. L., maint. engr., N. Y. N. H. & H., New Haven, Conn.
Pence, W. D., editor, Chicago.
Pendleton, D. E., asst. engr., C. & W. I., Chicago.
Penfield, W. H., engr. m. of w., C. M. & St. P., Chicago.
Persons, C. L., asst. ch. engr., C. B. & Q., Chicago.
Peterson, John, Cotton Belt, Illma, Mo.
Petri, Philip, div. engr., B. & O., Cumberland, Md.
Petticrew, C. B., div. engr., St. L. S. W., Illmo, Mo.
Pettus, J. K., asst. engr., N. S., Norfolk, Va.
Pfeifer, H. J., ch. engr., Terminal Railroad Association of St. Louis, St. Louis, Mo.
Phillips, H. C., cons. engr., Chicago.
Pierce, A. B., engr. water sup., Southern, Washington, D. C.
Pickles, J. L., ch. engr., D. W. & P., West Duluth, Minn.
Pinson, J. F., dist. engr., C. M. & St. P., Seattle, Wash.
Pittman, T. M., Jr., rdmaster, I. C., Water Valley, Miss.
Porter, H. T., ch. engr., B. & L. E., Greenville, Pa.
Porter, J. W., spec. engr., Can. Nat., Winnipeg, Man.
Pringle, J. F., asst. engr., G. T., Montreal, Canada.
Quigley, C. N., ch. engr., B. C. G. & A., Boyne City, Mich.
Radspinner, W. A., spec. engr., B. & O., Cincinnati, Ohio.
Ray, G. J., chf. engr., D. L. & W., Hoboken, N. J.
Reagan, J. H., supt. track, G. T., Detroit, Mich.
Reamer, R. V., engr. m. of w., Cent. of N. J., Jersey City, N. J.
Reasoner, R. B., div. engr., O. S. L., Pocatello, Idaho.
Reece, A. N., ch. engr., K. C. S., Kansas City, Mo.
Reichmann, Albert, div. engr., American Bridge Co., Chicago.
Reimann, Robert, asst. engr., B. & O., Relay, Md.
Reinholdt, J. H., supt., M. & St. L., Fort Dodge, Iowa.
Rench, W. F., civil engr., Chicago.
Ridgway, A. O., asst. ch. engr., D. & R. G., Denver, Colo.
Righter, G. E., div. engr., Erie, Buffalo, N. Y.
Righter, H. M., div. engr., Erie, Susquehanna, Pa.
Riley, D. A., engr. dept., B. & O., Baltimore, Md.
Riley, F. L., asst. engr. bldgs., B. & O., Baltimore, Md.
Ripley, H. L., corp. and val. engr., N. Y. N. H. & H., Boston, Mass.
Robinson, A. F., bridge engr. sys., A. T. & S. F., Chicago.
Rogers, E. I., ch. engr., P. & P. U., Peoria, Ill.
Rohan, E. N., asst. engr., m. of w., Wabash, Moberly, Mo.
Roof, W. R., bridge engr., C. G. W., Chicago.
Rossiter, L. P., div. engr., L. V., Buffalo, N. Y.
Rudd, A. H., ch. sig. engr., Penna., Philadelphia, Pa.
Ruff, J. S., div. engr., N. Y. N. H. & H., Boston, Mass.
Rupple, H. C., gen, rdmstr., Nor. Pac., Pasco, Wash.
Rust, T. E., ch. engr., W. C. F. & N., Waterloo, Iowa.
Safford, H. R., vice-pres., C. B. & Q., Chicago.
Salmon, J. M., bridge engr., L. & N., Lousiville, Ky.
Sampson, F. E., div. engr., B. & M., St. Johnsbury, Vt.
Schmitt, F. E., assoc. editor, Engineering News-Record, New York.
Schnacke, A. D., asst. engr., A. T. & S. F., Topeka, Kans.
Schofield, J., arch., Can. Nat., Toronto, Ont.
Scholes, T. R., asst. to ch. engr., C. B. & Q., Chicago.
Schram, I. H., reg. engr., Erie, Hornell, N. Y.
Scott, H. E., asst. engr., Wabash, Moberly, Mo.
Scowden, A. B., asst. engr. bridges, B. & O., Cincinnati, Ohio.
Selby, O. E., prin. asst. engr., C. C. C. & St. L., Cincinnati, Ohio.
Sesser, John C., engr. m. of w. & struc., W. & L. E., Brewster, Ohio.
Sexton, J. R., reg. engr., Erie, Huntington, Ind.
Sharp, J. S., engr. m. of w., Southern, Macon, Ga.
Sharpley, H. F., Jr., prin. asst. engr., Cent. of Ga., Savannah, Ga.
Shaver, A. G., consult. elec. and sig. engr., Chicago.
Shaw, B. B., div. engr., C. R. I. & P., Little Rock, Ark.
Shaw, W. J., Jr., div. engr., M. C., St. Thomas, Ont., Can.
Shields, A. C., div. engr., C. R. I. & P., Trenton, Mo.
Shoup, S. E., engr. asst. to gen. mgr., K. C. S., Kansas City, Mo.
Shurtleff, A. K., Chicago.
Silliman, Charles, group engr., President's conference committee, Washington, D. C.
Sills, J. M., dist. engr., St. L.-S. F., Springfield, Mo.
Simmons, I. L., bridge engr., C. R. I. & P., Chicago.
Sitton, G. L., engr. m. of w., Southern, Danville, Va.
Slibeck, G. J., ch. engr., Pettibone, Mulliken Co., Chicago.
Sloane, F. M., dist. engr., C. M. & St. P., Butte, Mont.
Sloggett, L. O., engr. of surv., I. C., Chicago.
Smith, F. A., civil engr., Chicago.
Smith, G. H., div. engr., T. & O., Bucyrus, Ohio.
Smith, G. L. G., asst. engr. of track, Nor. Pac., St. Paul, Minn.
Smith, H. C., div. engr., P. & R., Philadelphia, Pa.
Smith, H. L., mech. engr., D. L. & W., Dover, N. J.
Smith, Huntington, office engr., N. Y. C. & St. L., Cleveland, Ohio.
Smith, Lowry, asst. dist. engr., Nor. Pac., St. Paul, Minn.
Smith, R. M., asst. engr., Mo. Pac., St. Louis, Mo.
Snyder, G. W., gen. strkpr., Penna., Philadelphia, Pa.
Sparrow, L. L., prin. asst. engr., A. C. L., Wilmington, N. C.
Spell, W. A., asst. engr., A. B. & A., Atlanta, Ga.
Spencer, P. B., engr. of struct., N. Y. N. H. & H., New Haven, Conn.
Stansbury, H. E., res. engr., E. P. & S. W., Tucumcari, N. M.
Stedje, W. H., asst. engr., M. St. P. & S. S. M., Superior, Wis.
Steinmayer, O. C., supr. timb. pres., St. L.-S. F., Springfield, Mo.
Stelle, C. A., res. engr., C. & A., Chicago.
Stephenson, James, asst. engr., A. C. L., Wilmington, N. C.
Stern, I. F., cons. engr., First National Bank Building, Chicago.
Stevens, Thos. S., sig. engr., A. T. & S. F., Topeka, Kan.
Stewart, Geo. T., ch. engr., Cuban, Camaguey, Cuba.
Stimson, Earl, ch. engr. maint., B. & O., Baltimore, Md.
Stimson, F. J., ch. engr. maint., S. W. reg., Penna, St. Louis, Mo.
Stocker, J. A., ch. engr., T. & O. C., Columbus, Ohio.
Stout, H. M., record engr., Nor. Pac., St. Paul, Minn.
Strattman, C. R., junior engr., M. C., St. Thomas, Ont.
Stuart, H. B., struct. engr., G. T. R., Montreal, Canada.
Swartout, W. C., senior asst. engr., Mo. Pac., St. Louis, Mo.
Swartz, F. P., div. engr., St. L.-S. F., Fort Smith, Ark.
Swift, E. D., engr. m. of w., Belt, Chicago.

Talbot, A. N., prof. municipal and sanitary engr., University of Illinois, Urbana, Ill.
Taylor, C. M., supt. creosoting plants, P. & R. and Cent. of N. J., Port Reading, N. J.
Taylor, F. J., dist. engr., Nor. Pac., Livingston, Mont.
Taylor, R. T., trnmstr., Nor. Pac., Livingston, Mont.
Tebbets, G. E., Huntington, W. Va.
Thompson, F. L., chf. engr., I. C., Chicago.
Tinker, G. H., bridge engr., N. Y. C. & St. L., Cleveland, Ohio.
Tratman, E. E. R., western editor, Engineering News-Record, Wheaton, Ill.
Trenholm, J. B., engr. m. of w., A. C. L., Rocky Mount, N. C.
Trout, G. H., bridge engr., U. P., Omaha, Neb.
Utter, A. H., asst. engr., C. B. & Q., Lincoln, Neb.
Van Auken, A. M., Chicago.
Vandament, H. L., res. engr., C. & O., Huntington, W. Va.
Vandersluis, W. M., engr.-secy., Electrification Commission, I. C., Chicago.
Vernon, N. D., div. engr., Penna., Williamsport, Pa.
Wagner, S. T., chf. engr., P. & R., Philadelphia, Pa.
Walker, John, asst. engr., G. T., Barrie, Ont.
Walker, William, div. engr., G. T., Montreal, Can.
Wallace, D. A., Chicago.
Wallace, W. A., engr. depart., C. R. I. & P., Fairbury, Neb.
Walling, V. R., principal asst. engr., C. & W. I., Chicago.
Walters, H. N., div. engr., C. & O., Covington, Ky.
Watt, J. R., gen. rdmstr., L. & N., Louisville, Ky.
Watts, F. H., engr. m. of w., Penna., Chicago.
Weaver, C. E., engr. m. of w., Cent. of Ga., Savannah, Ga.
Weeks, Otis, div. engr., Sou. Pac., Ogden, Utah.
Welch, R. S., div. engr., B. & O., Newark, Ohio.
Wells, G. H., land appr., Wabash, St. Louis, Mo.
Welty, H. T., engr. struc., N. Y. C., New York.
Wendt, Edwin F., consul. engr., Washington, D. C.
Wenner, E. R., superv. bridges and buildgs., L. V., Wilkes Barre, Pa.
Westfall, C. C., engr. bridges, I. C., Chicago.
Weston, C. V., cons. engr., Chicago Surface Lines, Chicago.
Wherry, B. T., Chicago.
White, R. C., gen. supt., Mo. Pac., St. Louis, Mo.
Whiting, Charles L., supt. term., C. M. & St. P., Milwaukee, Wis.
Wickhorst, M. H., engr. of tests, rail committee, Chicago.
Wilks, J. R., asst. engr., C. R. I. & P., Des Moines, Iowa.
Williams, G. P., asst. engr. m. of w., Long Island, Jamaica, N. Y.
Williams, K. G., resident engr., Union, Memphis, Tenn.
Williams, R. W., engr. m. of w., Southern, Chattanooga, Tenn.
Williams, S. N., prof.-emeritus of civil engr., Oak Park, Ill.
Williams, W. D., engr. m. of w., Cin. Nor., Van Wert, Ohio.
Willis, L. E., office engr., M. K. & T., Parsons, Kans.
Wilson, G. L., engr. m. of w., Twin City Rapid Transit, Minneapolis, Minn.
Wilson, W. M., research prof. struc. engr., Urbana, Ill.
Wiltsee, W. P., asst. engr., N. & W., Roanoke, Va.
Winchester, P. H., div. engr. N. Y. C., Syracuse, N. Y.
Winship, Lef., div. engr., Mo. Pac., Nevada, Mo.
Wirth, A. A., asst. engr., Penna., Pittsburgh, Pa.
Wishart, J. G., office engr., C. R. I. & P., Chicago.
Withington, S., elec. engr., N. Y. N. H. & H., New Haven, Conn.
Woerner, A. H., div. engr., B. & O., Wheeling, W. Va.
Woods, A. A., chf. engr. m. of w. and struc., Southern., Cincinnati, Ohio.
Woozley, D. E., engr. m. of w., Union, Allegheny, Pa.
Worthing, E. E., sig. engr., Sou. Pac., Houston, Tex.
Yager, Louis, engr. m. of w., Nor. Pac., St. Paul, Minn.
Yates, J. J., bridge engr., Cent. of N. J., Jersey City, N. J.
Yeaton, F. D., asst. engr. of water serv., C. M. & St. P., Chicago.
Yewell, J. E., chf. drftman., B. & L E., Greenville, Pa.
Young, J. B., engr. of tests, P. & R., Reading, Pa.
Young, R. C., chf. engr., L. S. & I., Marquette, Mich.
Young, S. R., asst. chf. engr., A. & W., Atlanta, Ga.
Zabriskie, A. M., prin. asst. engr., Cent. of N. J., Jersey City, N. J.
Ziegweid, A. B., Hinsdale, Ill.
Zinn, A. S., Mo. Pac., St. Louis, Mo.
Zook, M. A., consult. engr., Plainfield, N. J.

Guests

Adams, Lem, rdwy. asst., U. P., Omaha, Neb.
Anderson, B. T., asst. sig. engr., D. L. & W., Hoboken, N. J.
Ashworth, W. G., rdmaster, N. P., Jamestown, N. D.
Babet, S. A., Cleveland, Ohio.
Barr, C. A., asst. rdmstr., Blue Island, Ill.
Bateman, E., U. S. Forest Service, Madison, Wis.
Batts, M. E., rdmster., L. & N. Pensacola, Fla.
Blake, M. P., supvr. water service, G. T., Bona Station.
Bloom, J. G., div. engr., C. R. I. & P., Fairbury, Neb.
Bibby, W., supvr., G. T., Cornwall, Ont.
Bischoff, J. M., office engr., Term. of St. L., St. Louis, Mo.
Bishop, F. J., asst. engr., L. S. & I., Marquette, Mich.
Bronson, C. B., N. Y. C., New York.
Buchanan, F. H., asst. ch. sig. engr., Penna., Philadelphia, Pa.
Campbell, J. M., div. engr., C. P., Winnipeg, Man.
Card, J. B., Central Creosoting Co., Chicago.
Casey, R. E., supt. Penna., Grand Rapids, Mich.
Catekir, E., supvr., G. T., Belleville, Ont.
Chesney, A. J., supvr., b. and b., G. T., Portland, Me.
Clark, W. H., G. T. W., Battle Creek, Mich.
Clopton, E. J., insp., B. & O., Baltimore, Md.
Clough, A. M., supvr., N. Y. C., Batavia, N. Y.
Coffin, S. V., supvr. b. and b., B. & M., Salem, Mass.
Congdon, C. A., track supvr., Rutland, Rutland, Vt.
Connelly, J. J., supt., G. T., Montreal, Que.
Cotter, J., rdmaster, G. T., Battle Creek, Mich.
Coyle, D. F., Winnipeg, Canada.
Craft, E. A., asst. to ch. engr., S. P., Houston, Tex.
Curtis, Allen, B. & A., Worcester, Mass.
Darling, C. S., Rock Products, Chicago.
David, T. H., p. a. e., Indianapolis Street Ry. Co., Indianapolis, Ind.
Davis, H. E., sales div. mgr., Grasselli Chemical Co., Cleveland, Ohio.
Dorland, A. G., asst. engr., E. J. & E., Gary, Ind.
Doyle, P., supvr. b. and b., G. T., Montreal, Que.
Dougherty, C. C., pilot engr., B. & O., Baltimore, Md.
Dunphy, K. A., div. engr., C. P., Souris, Man.
Edwards, D. W., Greenlee Bros. & Co., Washington, D. C.
Elmore, P. W., asst. div. engr., B. & O., Dayton, Ohio.
Farrell, W. J., div. VI, purchases and stores, A. R. A., New York.
Ferguson, H., supt. tracks, G. T., Toronto, Ont.
Frith, G. H., G. T., Montreal, Que.
Galvin, P., div. engr., M. P., Kansas City, Mo.
Gifford, G. D., gen. insp., N. Y. C., Rochester, N. Y.
Gilmour, R., supt., G. T., Montreal, Que.
Groves, H. H., asst. supvr. of track, B. & A., Boston, Mass.
Grow, J. H., engr. wood preservation, Milwaukee, Wis.
Hanson, L. J., sig. supvr., G. T., Montreal, Que.
Harding, C., supvr., b. and b., G. T., Battle Creek, Mich.
Haupt, E., pres., Strobel Steel Construction Co., Chicago.
Hawley, W. A., div. engr., Penna, New Castle, Pa.
Herndon, R. E., C. R. I. & P., Little Rock, Ark.
Hunt, F. S., div. engr., N. Y. C., New York.
Hunt, G. M., Forest Products Laboratory, Madison, Wis.
Huntsman, H. N., asst. engr., Wabash, Montpelier, Ohio.
Hurst, C. M., Hurst Automatic Switch & Sginal Co., St. Louis, Mo.
Janushek, A. J., pilot engr., B. & O., Baltimore, Md.
Johnston, B., Simplex Train Control Co., Rochester, N. Y.
Johnston, R. H., div. engr., C. B. & Q., St. Joseph, Mo.
Jurden, A R., div. engr., U. P., Kansas City, Mo.
Ivanhoff, J. D., G. T., Chicago.
Kaufman, P. E., contracting engr., Strauss Bascule Bridge Co., Chicago.
Kenyon, G. M., St. Paul, Minn.
Kearney, R. P., rdmaster, L. & W. V., Scranton, Pa.
Kirkpatrick, C. S., ch. engr., G. C. L., Houston, Tex.
Laboursadiere, H., supvr. trk., G. T., Montreal, Que.
Laird, A. N., asst. engr., G. T., Detroit, Mich.
Lewis, S. T., rdmaster, C. P., Empress, Alta.
Little, T. E., supvr. water serv., G. T., Montreal, Que.
Lockwood, J. F., gen. insp. of bdgs., C. & O., Richmond, Va.
MacKenzie, D., draftsman, G. T., Battle Creek, Mich.
Mackenzie, J. R., asst. engr., C. N., Toronto, Ont.
Marshall, J., special rep., Freight Claim Prevention, A. R. A., Chicago.
Maxwell, L. C., A. C. & H. B., Sault Ste. Marie, Ont.
McClennan, W. J., contr., C. C. C. & St. L., Cleveland, Ohio.
McCue, G. C., gen. supvr. b. and b., G. T., Ottawa, Ont.
McGuigan, rdmaster, St. L.-S. F., St. Louis, Mo.
McKeon, R. D., supt., Penna., Logansport, Ind.
McNab, L. G., engr. acct., G. T., Montreal, Que.
Menard, J. P., G. T., Montreal, Que.
Merritt, W. F., Cleburne, Tex.
Miller, H. E., Goodwin Car & Manufacturing Co., Inc., Chicago.
Montz, J. M., asst. on corp., B. & O., Washington, Ind.
Morgan, A. L., chf. engr., Des Moines Union, Des Moines, Iowa.
Morse, F. T., A. T. & S. F., Topeka, Kan.
Mumford, R. W., div. engr., C. & O., Ashland, Ky.
Nelson, W. O., asst. engr., B. & O., Pttsburgh, Pa.
Nicholson, G. A., drftman., B. & A., Boston, Mass.
Norris, H., asst. engr., A. C. L., Jacksonville, Fla.
O'Connor, B. J., contr., C. C. C. & St. L., Cleveland, Ohio.
O'Connor, J., rdmstr., C. R. I. & P., Fort Worth, Tex.
Ogilvie, C. S., asst. engr., G. T., Montreal, Que.
Phelps, C. E., St. Louis, Mo.
Piesch, H., engr. clerk, U. P., Omaha, Neb.
Pilcher, L., secy., Freight Claim Division, A. R. A.

Ray, A. L., instman., G. T., Durand, Mich.
Ready, J. T., rdmstr., C. R. I. & P., Waurika, Okla.
Redmond, A. V., dist engr., C. N., Winnipeg, Man.
Reeves, W. T., Robt. W. Hunt & Co., Chicago.
Reinert, W. A., asst. prof. civil engr., Armour Institute, Chicago.
Rhodes, E. O., chemical director, American Tar Products Co., Chicago.
Rogers, H. S., div. engr., D. & H. Co., Carbondale, Pa.
Ruthwen, A. L., Simplex Train Control, Rochester, N. Y.
Schauble, F., asst. supr. of track, B. & A., Pittsfield, Mass.
Scharbach, G. F., asst. engr., D. L. & W., Binghamton, N. Y.
Schultz, T. G., instman., G. T., Durand, Mich.
Scott, C. K., div. engr., Erie, Marion, Ohio.
Simpson, W. A., rdmstr., Clay Center, Kan.
Smith, F. M., rodman, B. & O., Pittsburgh, Pa.
Smith, H. E., asst. engr., G. T., Montreal, Que.
Starkie, J. L., office engr., G. C. & S. F., Galveston, Tex.
Stocking, E. J., vice-pres., Central Creosoting Co., Chicago.
Swartz, H. C., G. T., Montreal, Que.
Tisdale, A. A., asst. to gen. mgr., C. N., Winnipeg, Man.
Tomlinson, D. A., bgr. ry. bur., Portland Cement Association, Chicago.
Ueckert, H. H., engr. struct., S. P., Houston, Tex.
Wain, J. B., asst. engr., G. T., Montreal, Que.
Wamsley, Gale, sr. asst. engr., M. P., St. Louis, Mo.
Webster, J. W., E. J. & E., Joliet, Ill.
Weymouth, F. A., Bethlehem Steel Co., Bethlehem, Pa.
Wheeler, F. S., div. engr., Erie, Salamanca, N. Y.
Whellans, W. J., supt. work equip., C. N., Winnipeg, Man.
Wood, J. P., supvr. b. and b., P. M., Saginaw, Mich.
Worthington, E. D., asst. engr. val. dept., M. P., St. Louis, Mo.
Work, W., bldg. insp., G. T., Montreal, Que.

Registration of Signal Section, A. R. A.

THE FOLLOWING registered at the meeting of the Signal Section, A. R. A., at the Drake yesterday, bringing the total registration of members and guests for the two days to 400:

Representative Members

Acker, C. M., asst. sig. supr., D. & H., Albany, N. Y.
Anderson, A. H., sig. supr., C. B. & Q., Alliance, Nebr.
Bennett, C. H., sig. supr., L. & H. R., Warwick, N. Y.
Bishop, C. T., sig. supr, C. B. & Q., Aurora, Ill.
Cook, W. F., gen. mech. inspr., D. & H., Albany, N. Y.
Cormick, J. H., sig. engr., Can. Nat., Winnipeg, Man.
Gilbert, A. M., sig. supr., C. C. C. & St. L., Mattoon, Ill.
Green, R. E., asst. sig. engr., M. C., Detroit, Mich.
Hattery, C., asst. sig. supr., C. R. I. & P., Fairbury, Nebr.
Hemphill, F. J., supr. sigs., C. R. I. & P., Trenton, Mo.
Hiles, W., chf. sig. inspr., C. C. C. & St. L., Cincinnati, Ohio.
Hilliard, E. J., supr. sigs., C. & N. W., Boone, Ia.
Hoffman, S. C., sig. supr., I. C., Champaign, Ill.
Homuth, W., asst. sig. engr., C. & N. W., Allis, Wis.
Ishler, O. A., asst. supr. tel. & sigs., Penna., Pittsburgh, Pa.
Johnson, T. L., sig. supr., D. L. & W., Binghamton, N. Y.
Jones, I. S., elec. engr. of sigs., Nor. Pac., St. Paul, Minn.
Kunde, F. L., sig. supr., C. B. & Q., Ottumwa, Iowa.
Lollis, B. F., gen. sig. inspr., C. B. & W., Chicago, Ill.
Mansfield, C. C., asst. sig. supr., C. & N. W., Maywood, Ill.
Mill, J. C., sig. engr., C. M. & St. P., Milwaukee, Wis.
Mock, H. F., sig. supr., C. & N. W., Green Bay, Wis.
Orr, H. H., sig. engr., C. & E. I., Chicago.
Parker, C. W., sig. engr., Can. Pac., Montreal, Canada.
Palmer, A. C., supr. sigs., Vicksburg, Miss.
Pfleging, F. W., sig. engr., U. R., Omaha, Nebr.
Rhymer, S. U., supt. tel. & sigs., C. & A., Bloomington, Ill.
Seifert, T. C., gen. sig. inspr., C. B. & Q., Chicago.
Smith, L. W., asst. sig. engr., C. M. & St. P., Tacoma, Wash.
Snyder, J. W., supr. tel. & sigs., Penna., Madison, Wis.
Tyler, R. F., gen. sig. for., C. M. & St. P., Tacoma, Wash.
Weatherby, E. P., sig. engr., T. & P., Dallas, Tex.
Wells, F. G., sig. supr., C. & N. W., Chicago.
Wiegand, C. H., sig. supr., A. C. L., Savannah, Ga.

Railroad Affiliated Members

Bears, A. M., sig. supr., Can. Pac., Winnipeg, Man.
Bills, H. R., sig. supr., Wabash, Lafayette, Ind.
Gardner, R. C., sig. inspr., Can. Nat., Saskatoon, Man.
Hossman, W. R., sig. supr., K. C. Term., Kansas City, Mo.
Leisenring, J., sig. engr., Ill. Trac., Springfield, Ill.
Leonard, F. A., sig. constr., acc't., C. & N. W., Chicago.
McConahay, J. F., sig. maintr., Nor. Pac., Verndale, Minn.
Punter, W. M., sig. engr., Can. Nor., Toronto, Ont.
Ryan, F. J., supr. sigs., I. C., Freeport, Ill.
Schultz, E. E., engr., sig. dept., C. & N. W., Chicago.
Starkweather, F. E., asst. sig. engr., P. M., Detroit, Mich.

Affiliated Members

Fenley, W. H., sales engr., Kerite Insulated Wire & Cable Co., Chicago.
Frink, O. B., gen. inspr., Hall Switch & Signal Co., Garwood, N. J.
Garrity, P. A., west. sales mgr., Thos. A. Edison, Inc., Chicago.
Reichard, W. H., asst. gen. mgr., Federal Signal Co., Albany, N. Y.

Guests

Behymen, R. H., sig. maint., C. & O., Covington, Ky.
Class, E. K., supt. teleg. & sigs., C. G. W., Dubuque, Ia.
Claus, draftsman, I. C., Chicago.
Ferguson, J. L., supr. sigs., N. & W., Bluefield, W. Va.
French, C. C., asst. sig. engr., C. C. C. & St. L., Cincinnati, Ohio.
Hard, Ture, sig. engr., Stockholm, Sweden.
Johnson, Homer C., sig. inspr., C. & O., Cincinnati, Ohio.
Love, Luther J., Kenmore, Ohio.
Mugen, D. B., Edison Storage Battery Co., Orange, N. J.
Mullen, W. G., gen. sig. inspr., C. G. W., Chicago.
Partridge, G. F., supr. sigs., A. C. L., Florence, S. C.
Piper, Arthur G., Toronto, Ont.
Rice, Robt., W., sig. maint., D. & H., Castleton, Vt.
Shotwell, E. V., sig. supr., C. & N. W., Chicago.
Takeguchi, H., sig. engr., Southern Manchuria, New York.
Wilson, Hugo, chf. engr., A. B. Vaxlar & Signals, Orebro, Sweden.

Improvements in the Eymon Continuous Rail Crossing

IMPROVEMENTS IN THE method of operating and locking the movable blocks in the Eymon continuous crossing have added materially to the ease of connecting it with interlocking facilities and to the safety of its operation. The principal feature of this crossing is four triangular blocks of steel, designed to fit into the exterior angles of the four corners of the crossing and arranged to slide in a direction perpendicular to a line bisecting the angle of a corner, so that either one or the other flangeway is

Photograph of a Crossing in Service

closed. Thus a continuous rail may be provided for either track at will.

The new system of operation and locking of the movable blocks is accomplished by the "lock and block" movement, shown in the photograph. This apparatus has been designed particularly for this crossing and yet employs the principle of locking familiar to interlocking men. The lock of this movement locks normal in one position and reverse in the other position, and is unlocked or neutral on the center. The quadrant of the locking lever in the interlocking machine is "notched" on the center to hold

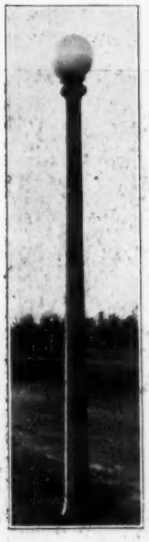
the lever in the unlocked position, while throwing the lever used for shifting the movable blocks.

Referring to the photograph, it will be seen that the movable block "F" is held in its position by the locking rod "C," which fits in bar "D" attached to the movable block. When changing the line-up for traffic on the other road, the first movement is to withdraw the locking rod "C" and by switching the operating rod "B" away from the reader the block "F" is moved in the direction of the arrow by means of lugs on the bottom, which fit over an offset on the rod "B," which extends on through to the bearing "E." It will be seen that as the block "F" moves over the locking bar "D" is carried along to such a position that it is now possible to push the rod "A" into the notch "N."

By means of this apparatus it is possible to operate and lock the entire crossing with one lever in the interlocking machine. However, it should be understood that if the levers are available in the interlocking machine there would be no objection to using one lever to operate and another lever to lock each crossing, which is a question to be decided by the signal engineers of the individual roads. This crossing is manufactured by the Eymon Crossing Company, Marion, O.

Recent Developments in the Use of Concrete Poles on Railroads

THE LAST FEW YEARS have witnessed a considerable interest on the part of the railroads in the use of reinforced concrete poles and other similar structures, particularly where the requirements of low cost and utility are coupled with a desire for architectural treatment. In this connection, therefore, it is of interest to note the type of pole recently installed by the Pere Marquette at its depot at Belding, Mich.



The Posts at Belding

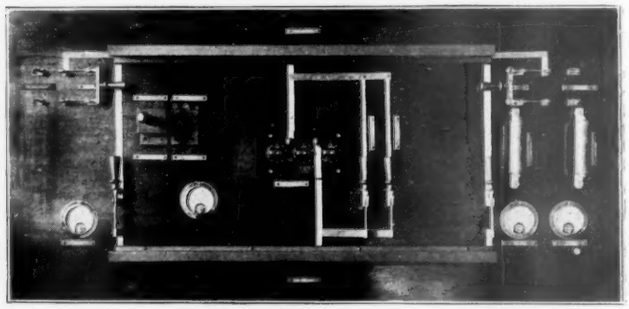
These standards were furnished by the Massey Concrete Products Corporation, Chicago. They are 13 ft. high, of hexagonal cross-section, and embody what is known as the Hollowspun type of construction, the essential feature of which is the placing of a wet mixture of concrete in a form containing the reinforcing steel and revolving at a high rate of speed, an operation which not only serves to compact the concrete around the reinforcing steel but also to leave a cylindrical opening throughout the length of the pole, thereby reducing the weight and the attendant inconvenience of handling. The type of pole used in this case is shown in the accompanying illustration.

A similar type of lighting standard, though shorter in length, has been developed by the same company for mounting on bridge railings, and poles of the same construction, though circular in section, have recently been installed on several railroads as bridge warning supports. Examples of the latter are to be found in the poles used on the Illinois Central bridge over the Kankakee river at Kankakee, Ill., also the poles erected on the Pennsylvania at Philadelphia, the New York Central at Lyons, N. Y., and in the electrified zone of the Norfolk & Western near Norfolk, Va. One interesting observation to be made in connection with the strength of the poles is to be found in the survival of a transmission line of the American Telephone & Telegraph Company during a storm in New England last December, which proved disastrous to most of the transmission lines in the section.

Miniature Track Circuit for Testing

SIGNALMEN HAVING trouble with track circuit adjustments are frequently required to wait from week to week in order to catch the extremes of wet track, frozen ballast or dry weather. On account of this tedious program the limiting resistance is often reduced to the minimum and left at this adjustment in order to insure proper operation during extreme conditions, regardless of the energy consumed. Also during tests carried on to determine the operating characteristics of track relays of different resistances, a means of expediting adjustments for different ballast conditions is very desirable.

The miniature track circuit shown in the photograph incorporates in a space readily seen at a glance, connections for the various batteries, resistance units, relays and



The Miniature D. C. Track Circuit

rails used in an ordinary track circuit. The double-pole double-throw switch at the right, when in the normal position, connects a primary battery to the rails and when reversed connects a storage battery to the circuit. A limiting resistance of 3.5 ohms is connected in series with the storage battery and a 0.3 ohm in series with the primary battery. The one ammeter indicates the battery discharge to the track circuit, while the other shows the charging rate of the storage battery.

The double-pole, double-throw switch at the left of the picture, when in the normal position, connects a 4-ohm relay to the rails or a 2-ohm relay to the same circuit when reversed. The ammeter below this switch indicates the milli-amperes going through the relay coils. The voltmeter between the rails may be connected by means of the multiplying switch to indicate the track volts at the relay end, the track volts at the battery, the voltage of the primary battery or the storage battery.

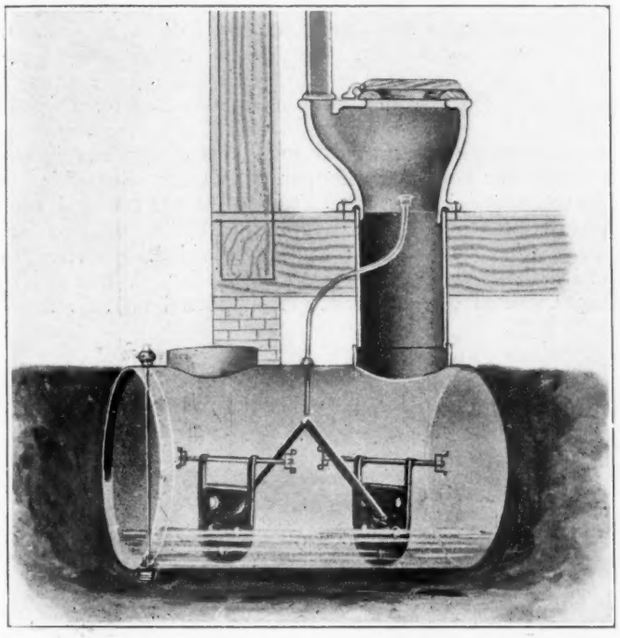
Each rail has a resistance of 0.3 ohms and between the rails is mounted an adjustable resistance box, by means of which resistances in tens, units and tenths may be set up to represent various track circuit leakages. The closing of either of the single pole switches to the right of the resistance box represents a train shunt of 0.12 ohms or with both closed a resistance of 0.06 ohms. The single pole switch at the left end of the rails acts as a train shunt at the relay, while the switch of the right end represents a train shunt of the battery end.

By assembling the various functions of the track circuits it is readily seen that the action of different units may be checked at one time. As a means of training new men in the signal work or as a method of demonstrating to maintenance of way or operating officers why certain track circuits need cleaning out, such a model should serve a valuable purpose. The Electric Storage Battery Company, to whom we are indebted for the photographs,

now have two such miniature track circuits which are used for demonstrating purposes.

Chemical Toilets for Railway Service

THE CHEMICAL TOILET is a development of recent years. A system of sewage disposal based upon the deodorizing, decomposing and purifying action of a chemical solution and adapted to installation indoors is a marked improvement over the privy vault as a method of meeting the toilet problem at points where a sewerage system is either not possible for lack of a water supply for flushing and disposal purposes or an unwarranted ex-



A Sectional View of the Wolverine System

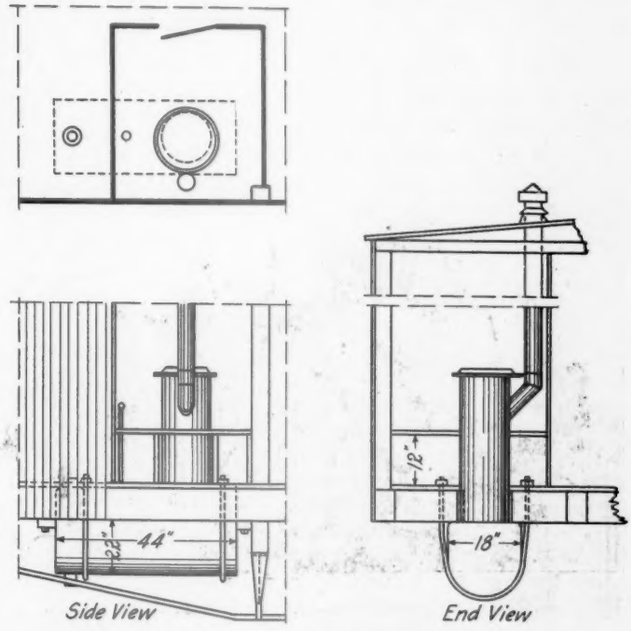
pense. On railways it thus invites consideration in connection with passenger depots, small shops, and construction camps at outlying or other points where the privy vault is tolerated only because of the lack of better facilities, and merits consideration also with respect to signal towers, watchmen's shanties and outfit cars, where, although some facilities are greatly to be desired, even the privy vaults are often wanting.

Constituting one of these systems the Wolverine equipment presents a new point of interest for railway men in the provision which has been made for its installation in outfit cars and similar places where space is limited and inexpensive though durable equipment is required. The modifications made in the equipment to this end will be more clearly brought out by first reviewing the design of the standard system. As shown in the accompanying illustration, the equipment consists of a cylindrical tank, horizontally placed beneath the building, and a pipe which extends to the floor line, where it connects with a vitrified bowl, this bowl carrying an appropriate seat and cover and accommodating a ventilating system which in turn consists of galvanized piping extending far enough above the roof to establish an effective draft. Within the cylinder are two paddles, each suspended from a horizontal shaft and both so connected to a rod extending above the floor as to require only a push on the rod to effect a proper mixing of the chemical with the other contents of the tank.

The chemical itself is a caustic preparation which is prepared for use by dissolving in a pail of water, after which it is dumped into the tank and sufficient water added to give a three or four inch depth to the solution. The action of this chemical and the agitator serves thereafter to liquify all solid matter, kill germs, and suppress all offensive odors until after five or six months when the tank becomes about three-fourths full, when the contents are pumped out through the man-hole provided on the upper side of the cylinder or removed through the drain hole at one end of the under side, this drain being controlled, as shown in the photographic illustration, by a rod which extends up through the upper side of the tank.

For the use of this system in outfit cars a tank is now made of a size and shape which permits of its being installed securely above the truss rods at one end of the car. As shown in the illustration, the tank is secured to the car floor by two U-bolts. Within the car the equipment differs from the standard single bowl equipment in the use of a long steel tube of 12-in. diameter in the place of the shorter tube surmounted by the vitrified bowl. Similarly to the vitrified bowl this tube accommodates an appropriate cover and the regular ventilating system, but affords a less expensive construction. With this equipment it is necessary only to erect a false floor around the drop pipe to complete the installation for such purposes.

Constructed in the manner described the system allows adequate clearance below the car and occupies but little

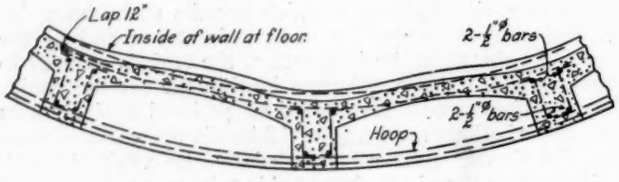


Method of Installing the Toilets in Outfit Cars

space within it. Obviously its value is particularly to be realized in bunk cars occupied during the winter season, and during summer seasons in those cases where cars are allowed to stand in one spot for long periods of time. The units require no more attention than should reasonably be given to a water flushed system and present no offensive features in connection with their emptying and recharging. The chemical is furnished in batch quantities in cartons ready for mixing and while destructive to organic matter is not corrosive to the metal of the tanks. These systems are sold by the Superior Supply Company, Chicago.

New Data Bearing on Gunite in Tank Construction

AN ACCOUNT OF an old gunite-constructed tank was recently unearthed by the Cement-Gun Company, Inc., Chicago, to which considerable interest attaches by reason of the showing made by the gunite in this kind of construction and in the study it affords in structural design. A view of the tank as it was last found is shown in the accompanying illustration, it having been abandoned for purposes mentioned later. This tank was built in Henrietta, Okla., in 1917 for oil storage purposes and stood for 3½ years in such service, when a new purchaser of the property, who did not need the tank in



A Section of the Side of the Tank

his business and found it in the way of a building he desired to construct, undertook to remove it. Three shots of dynamite beneath the tank failing to do more than loosen ground around the foundation, resort was had to block and tackle and horses and finally after tippinig the tank over on its side, it was rolled by means of tackle for a distance of 900 ft. to the point shown in the photograph. At the time the tank held about a half a car of crude oil, which was removed by drilling through the tank. It was also observed that no signs of oil were to be found on the exterior of the tank or other indications of any seepage through the structure during its life.

The excellent showing made by the tank during the 3½

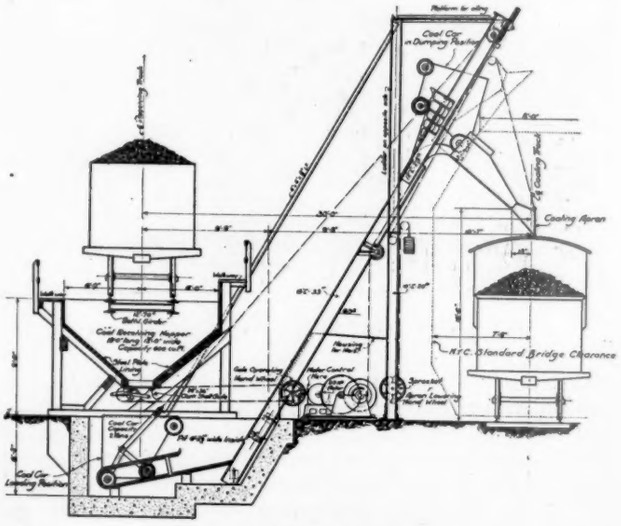
The Tank After Its Demolition

years in which it was in service and the resistance it presented to demolition are attributed to the manner in which the tank was constructed. The nature of this construction may be gathered from the accompanying photograph and drawing, in which it will be noted that the tank is essentially a system of vertical ribs occurring at intervals around the shell, coupled with a system of horizontal ribs situated at intervals above each other, varying according to the intensity of the pressure. In each vertical rib was a rod of reinforcing steel. The shell was built up by applying gunite to a steel mesh and, as is particularly to be noted, the tension steel was entirely external, appearing in the photograph as so many hoops around the tank. By reason of this design, expansion and contraction was evidently taken up adequately and the concrete was maintained under compression.

A New Development in Engine Coaling Equipment

IN THE ACCOMPANYING view is shown one of two small plants, one electrically and the other pneumatically operated, which have recently been developed by the Roberts & Schaefer Company, Chicago, to replace the old hand shoveling methods of coaling locomotives at outlying points, where the installation of more elaborate coaling facilities is not warranted, where the problem of engine coaling is of a nature to invite scientific treatment.

In these plants the coal is dumped from a gondola car into a receiving hopper, which can be designed for a capacity of 600 to 2,000 cu. ft. This receiving hopper is equipped with a 24 in. by 36 in. clam-shell gate, which is operated by a hand wheel in the hoist house, thereby making it possible for the coal to be fed by gravity into a two-ton car below the hopper. This car when filled is then elevated by air or electricity on a structural steel supporting frame to the dumping point above the coaling track, where a hooded apron is provided, by means of which the coal is spouted into the tender. When dumping, the coal car or bucket is supported on substantial



Plan of the Coaling Plant

dumping castings, and when empty is returned by gravity to the loading position. The trip from the loading point to the dumping point and return takes about 1½ min.

The electrically-operated plant is provided with a 20 hp. electric motor, with Cutter-Hammer hand controller, solenoid brake and a machine time limit switch, which automatically stops the bucket at the dumping point, and prevents any overwind. The motor is direct connected through cut steel gears to a cast iron base winding drum hoist. Standard New York Central bridge clearances are adhered to in designing the structure, which makes it possible to install this plant on main line, or yard tracks.

The operation of the plant is simple, the regular shop or yard forces being able to take care of the coaling of the engines along with their other duties. It is therefore possible to release cars promptly and to avoid keeping laborers on duty at all times to shovel coal by hand. As an additional feature or possibility of the plant obviously lies in the adaptability of it for transferring material from bad order cars.